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THE

REPERTORY

OF

PATENT INVENTIONS

AND OTHER

DISCOVERIES AND IMPROVEMENTS

IN

ARTS, MANUFACTURES,

AND

AGRICULTURE,

BEING A CONTINUATION, ON AN ENLARGED PLAN, OF THE

Repertory of Arts and Manufactures,

A WORK ORIGINALLY UNDERTAKEN IN THE YEAR 1794, AND STILL CARRIED ON, WITH A
VIEW TO COLLECT, RECORD, AND BRING INTO PUBLIC NOTICE,

THE USEFUL INVENTIONS OF ALL NATIONS.

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THE
REPERTORY
OF
PATENT INVENTIONS, &c.

No. I. JULY, 1825.

Specification of the Patent granted to Frederic Lewis Fatton, *of New Bond-street, in the county of Middlesex, watchmaker, for an astronomical instrument or watch, by which the time of the day, the progress of the celestial bodies, as well as carriages, horses, or other animals, may be correctly ascertained. Partly communicated to him by a foreigner residing abroad.* Dated Feb. 9, 1822.

◆

WITH AN ENGRAVING.

◆

TO all to whom these presents shall come, &c. *Now know ye*, that in compliance with the said proviso, I, the said Frederick Lewis Fatton, do hereby declare the nature of the said invention of an astronomical instrument or watch, by which the time of the day, the progress of celestial bodies, as well as carriages, horses, or other animals, may be correctly ascertained, as is particularly described and ascertained in and by the annexed sheet of drawings or plans, and in the following description thereof, that is to say:

Fig. 1 (see Plate I.) on the annexed sheet of drawings represents the instrument as it would appear with the dial plate taken off, in order to explain the construction of the mechanism which lies beneath it.

Fig 2 shows an elevation or section of part of the instrument, supposing the ordinary spring barrel, fusee, escapement, and other parts of the time-keeper or watch, to be removed, as they do not constitute any part of the said invention.

Fig. 3 represents a plan of the instrument, with the hands and dial plate in their proper situations; the same letters of reference are used to denote corresponding parts in all the figures: A, fig. 1, shows the cock to support the upper part of the escapement wheel, the place of which wheel is represented by the dotted circle, *a*, *a*; but the escapement itself, as well as the spring barrel, fusee, and other parts constituting the ordinary movements of time-keepers or watches, may be employed; and being so well understood, I shall not enter into any particular description of them. A small pinion is fixed upon the upper end of the arbor or axis of the escapement wheel, which pinion engages in the teeth of a wheel, S, the arbor or axis of which wheel passes through a cock, or support, *c*, and carries a revolving dial plate, D, upon its upper extremity, as seen in figs. 2 and 3, and also by the dotted circle, *d d*, in fig. 1; the revolving dial plate and wheel, S, make a complete revolution in one minute, and has 60 divisions marked upon its surface, as seen at D in fig. 3, to indicate seconds of time, being numbered at every five seconds; the wheel, S, has a pinion, C, of 8 teeth fixed to it, engaging in the teeth of a wheel, E, of 72 teeth, situated beneath the plate, X, X, as seen in fig. 2; the upper part of the arbor or axis of the wheel, E, is furnished with a wheel, F, of 60 teeth, which engages with the teeth of the small wheel, G, of 30 teeth, having upon its axis or arbor a pinion of two leaves or teeth, engaging in the teeth of the wheel, H, of 120 teeth, the axis of which carries the hour hand of the instrument, and makes one complete revolution in 5 hours, the dial being numbered at every hour, as seen at *h*, in fig. 3; the teeth of the small wheel, G, engage into the teeth of the wheel, M, of 60 teeth, seen in figs. 1 and

2; the arbor or axis of which carries the minute hand, and makes one complete revolution in 10 minutes; the dial is numbered at every minute, as seen at *m*, in fig. 3; the arbor or axis of the wheel M has a snail or spiral plate, O, fixed upon it, the object of which will be hereinafter explained: P, fig. 1 and 2, represents a flat plate of metal, which moves upon an axis or arbor at *e*, the upper pivot of which is supported in the fixed cock, I, and the lower pivot turns in the plate, X; X, fig. 2; the plate P has a projection or beak, *p*, formed on one side thereof, the extremity of which beak bears against the circumference of the snail or spiral plate, O, and is always kept into close contact by the force of the spring, K, which acts upon the plate, P, near to the axis, *e*, as seen in fig. 1: N shows a small standard, screwed fast upon the plate, P; it is divided into a fork at the top, and furnished with two centre screws to support the pivots of a short axis, *r*, having a lever or arm, T, projecting from it on one side, and a short beak or detent, *t*, on the opposite side of the said axis. The detent, *t*, is borne upwards by a spring, S, which spring operates to depress the extreme end of the lever, T, which extends or reaches some distance over the surface of the revolving dial plate, D. The axis, *r*, has also a small detent or arm, *w*, projecting downwards, or nearly at right angles with the lever, T, as seen in fig. 2. The lower extremity of the detent, *w*, is acted upon by the points of the notched or star wheel, *x*, which is fitted so as to turn freely round upon a small screw fixed in the plate, P, and is caused to remain at rest with its points always in one certain position, by means of the slight spring, *k*, screwed fast to the plate, P, having a double inclined plane or wedge-piece formed at its extremity, which falls in between two of the points of the star wheel, and thereby determines its position. The star wheel, *x*, is moved round a space of one tooth at a time by the bent lever, *v*, which turns upon a screw, *n*, fixed in the plate, P; the end, *v*, of the said lever is guided and kept down upon the plate, P, by passing under the head of a screw, *o;* and the opposite end near to the centre screw, *n,* is bent in a reverse direction, and has a projecting piece, *q,* formed to an arc of a circle, described round the centre or axis, *e,* of the plate, P; the piece, *q,* is acted upon by the small pin or button, *z,* which projects through the external case of the instrument, so as to be capable of being pressed upon by the finger in using the instrument. The bent lever, *v,* is limited in its motion by having a groove formed in the part *q,* which groove slides round the axis, *e,* and comes to bear firmly upon the said axis; when the button, *z,* is forced in sufficiently, the bent lever, *v,* is caused to return to its original position, when the button, *z,* is left at liberty, as seen in fig. 1, by the force of a small spring, *y,* which is screwed fast upon a projecting part of the plate, P, and bears against the bent lever, *v,* nearly opposite to the place where the button, *z,* acts; the lever or arm, T, is furnished with a small screw, 1, at its extremity, as seen in fig. 2, which screw passes through the end of a slight steel spring, 2, having a nib or beak formed in it similar to a pen, for the purpose of containing a small quantity of ink or colour, as will be hereinafter explained. The slight spring, 2, is made square at one end, and is screwed fast to the arm, T, near to the axis, *r;* 3 shows a screw passing through the arm, T, the point of which rests upon the end of a spring, 4, fixed to the plate, P, as seen in fig. 1. The action of the above described mechanism is as follows: when the button, *z,* is pressed so as to bear against the arched part, *q,* of the bent lever, *v,* it move the said lever round its centre screw or axis, *n,* and causes the end of the lever, *v,* to press against one of the points of the star wheel, *x,* and move the said star wheel round upon the centre screw at the same time that one of the points of the star wheel is in contact with the extremity of the detent, *w,* and by the motion of the said star wheel forces the detent, *w,* to move round its axis, *r,* and thereby raises the end, 1, of the lever, T, up from the surface of the revolving dial, at the same time depressing the spring, *s*, until the point of the star wheel has advanced sufficiently to quit the end of the detent, *w*, at which instant the spring, *s*, re-acts against the beak, *t*, and throws the end, 1, of the lever, T, suddenly down, so as to cause the nib of the spring, 2, to touch or strike the surface of the revolving dial, D, by its momentum overcoming the force of the spring, 4, which the screw, 3, bears upon, as hereinbefore described; the inclined part of the spring, *k*, falls between two of the points of the star wheel, and places it in a proper position to repeat the action; the bent lever, *v*, is returned to its original situation by the spring, *y*, before mentioned; the end, *v*, of the bent lever, is furnished with a spring piece, as shown at 6, in fig. 1, which yields sufficiently to allow the lever to return freely by the points of the star wheel. The action of the above described mechanism is so sudden, that a person may cause the nib of the spring, 2, to strike the revolving dial, D, five or six distinct blows in each second of time, if required, for a rapid succession of observations. The manner of preparing the instrument for an observation is as follows: the main spring of the instrument should be wound up by its key into a state ready to act, having its motion suspended by means of the small stop, 8, projecting through the side of the case, as in ordinary stop watches; after which, the arm, T, should be raised up some distance from the surface of the revolving dial plate, D, by pressing the finger upon the small pin, 5, fig. 2, in which situation a minute quantity of colour (prepared by grinding tripoli, or other coloured substance, with olive oil) is to be introduced by means of a camel hair pencil or otherwise, into the nib of the spring, 2, beforementioned. When this is done, the lever, T, is left at liberty, and the point of the screw, 3, comes to bear upon the end of the spring, 4, which prevents the nib of the spring, 2, from touching the surface of the revolving dial plate; the minute hand, *m*, should be placed at the number 10, and the revolving dial plate, D, turned round, until the number 60 be brought opposite to the arm, T, as seen in fig. 3, in which situation the nib of the spring, 2, containing the colour as before mentioned, will be near the outer circumference of the revolving dial plate, D. Now suppose, for example, I wish to ascertain and register, by this instrument, the precise moment of one body or object passing by another, I first observe the time of day by any good watch or time-keeper, and by means of the stop 8, set the instrument in motion at a known or determined time, holding the instrument in the hand, with the end of the fore finger bearing lightly upon the button, *z*, seen in figs. 1 and 3; whilst the instrument is in motion, the divisions upon the face of the revolving dial plate, D, pass regularly under the nib of the spring, 2, but without touching the same, and the minute hand, *m*, advances one division during an entire revolution of the dial, D; when the instant arrives which I wish to note or ascertain, I press the button, *z*, with a sudden motion of the fore finger, which causes the lever or arm, T, to rise and fall again almost instantaneously, by the operation of the star wheel, bent lever, &c. as hereinbefore described; this action causes the nib of the spring, 2, to strike slightly upon the surface of the revolving dial, and leave a permanent mark or dot; the nib of the spring, 2, does not remain in contact with the surface of the dial any sensible time, but is thrown up again almost instantaneously, by the action of the spring, 4, bearing against the point of the screw, 3, as before mentioned, the nib being caused to touch the dial by the momentum of the lever, T, overcoming the resistance of the spring, 4, in a slight degree, that being sufficient to leave a visible mark or dot of colour upon the revolving dial, D, by alternately pressing and relieving the button, *z*; in this manner, a succession of marks or dots may be made upon the dial, D, without looking at it, if required for a number of observations, occurring suddenly after each other, and read off at leisure from the dial. The instrument above described is capable of marking distinctly upon the revolving dial plate D, a series of observations during 10 minutes of time, without interruption, or danger of any one mark or dot interfering with another. I have already mentioned that the nib of the spring, 2, is near the outer circumference of the revolving dial plate, D, when the instrument is first set in motion to commence the observations. I have also stated that the spring, 2, with the star wheel and other mechanism, which causes the nib of the said spring to mark upon the dial plate when required, was mounted upon a plate of metal, P, capable of moving round a centre of motion, *e*, in the annexed drawing, and it remains for me to explain how the requisite motion is communicated to the plate, P. When the minute hand, *m*, points to the number 10, as in fig. 3, the projecting beak, *p*, of the plate, P, is acting against the smallest diameter of the snail or spiral, O, which allows the nib of the spring, 2, to recede from the centre of the revolving dial plate, D, near to the circumference thereof; and as the minute hand turns round along with the snail or spiral, O, once in ten minutes, the motion of the snail causes the nib of the spring, 2, to approach the centre of the revolving dial, D, gradually, so that the succession of dots or marks which may be made upon the revolving dial plate will be arranged in a spiral direction, commencing at the circumference, and approaching the centre, forming ten complete evolutions, each evolution indicating a minute of time, and the place where the dots or marks happen to fall upon the radial line, drawn upon the dial, as seen in fig. 3, indicate the seconds of time; as soon as the minute hand, *m*, has completed its revolution, the beak, *p*, of the plate, P, will drop suddenly towards the centre of the snail, O, by the action of its spring, *k*, before mentioned, and remove the nib of the spring, 2, to the outer circumference of the revolving dial, from where it first started; when it is required to commence a new series of observations with this instrument, the dots or marks previously made must be cleaned off the surface of the revolving dial, D, by means of a piece of linen cloth; the dial itself is made so as to be easily removed for that purpose. The radial lines, indicating seconds upon the revolving dial, are not drawn in straight lines, pointing to the centre, but are described by arcs of a circle, the radius of which is determined by the distance between the nib of the spring, 2, and the arbor or axis, *e*, of the plate, P. The instrument above described requires to be wound up every five hours, so that it is not adapted to be used as a watch or time-keeper, but might, if required, be made to serve both purposes, by having the hour circle, *h*, divided and numbered with the twelve hours, and the hour wheel work so arranged, that the hour hand, *k*, would make one complete revolution during 72 revolutions of the minute hand, *m*.

In some cases I do not employ colour to mark upon the revolving dial, as before described, but I make the nib of the spring, 2, with a fine point of steel, like a needle, and I make the revolving dial plate of tinned plate, or other soft metal, in such manner that it can be easily taken on and off the arbor of the seconds' motion. In this form of the instrument, a number of dial plates are provided, and the nib or point of the spring, 2, makes a distinct dot or puncture on the surface of the soft metal when required, which obliges a new dial plate to be used for every series of observations, and admits of preserving the marked ones undestroyed. Fig. 4 upon the sheet of drawing represents another form of the instrument, being adapted to a common watch; *h* represents the circle for the hours and minutes, and D, the revolving dial plate, which is fitted upon the arbor of the ordinary seconds' hand, so as to make a complete revolution in one minute, and is numbered at every 10 seconds: T shows the small lever, carrying the nib to contain colour, and mark upon the face of the revolving dial, D, to produce the dots or marks. The motion to produce the dots or marks is effected by the button, *z*, exactly in the same manner as described

Fig. 8.

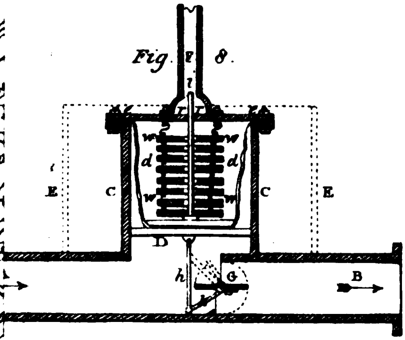


Fig. 7.

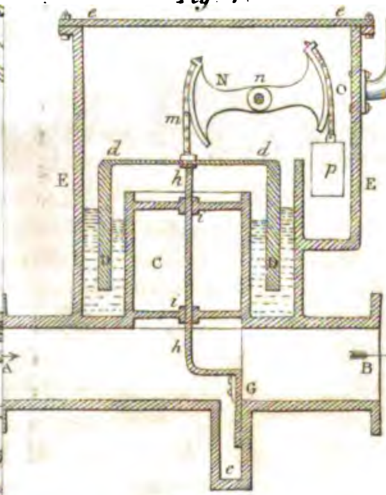
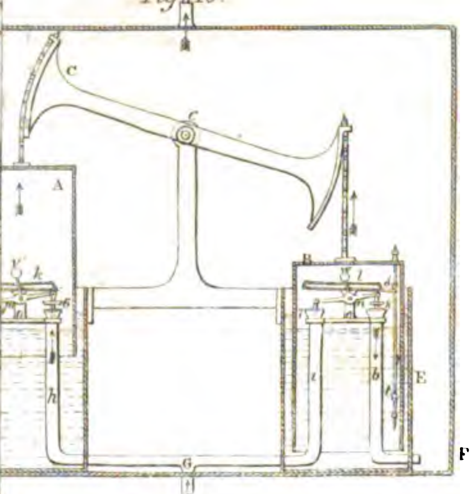


Fig. 10.



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for the former figures; but the movement which is therein described, which causes the nib of the lever, T, to approach or recede from the centre of the dial, D, is not used at all in this figure, it being intended only to dot or mark during one revolution of the dial, D, before cleaning them off; consequently, the lever, T, with its star wheel, &c. are mounted upon a fixed plate instead of a moveable one, as described in the former figure: 8 shows a small button, which serves to stop the motion of the watch when required.

Figs. 5 and 6 represent part of the instrument, upon a different construction: the figs. 5 and 6 are drawn to the same scale as the figs. 1, 2, and 3. In this construction the dial plate is fixed, and the dots or marks are made upon it when it is required to ascertain any precise moment, by means of the seconds' hand revolving, and carrying a nib at its extremity, furnished with colour: P shows a plate of metal upon which the mechanism is placed, as in the former figures, except that it has no motion round a centre, as described at *e*, in figs. 1, 2, and 3, but is stationary: N shows a small standard, screwed fast upon the plate, P, which serves to carry the axis, *r*, of the lever or arm, T, with its short detent, *t*, and perpendicular arm or detent, *w*, against which the point of the star wheel acts as hereinbefore described; for the movement in figs. 1, 2, and 3, *s*, shows a small spring, which bears up the short detent, *t*, and depresses the lever or arm, T, till it rests upon a fixed stop in the standard, N: the end of the lever or arm, T, is formed like a small circular plate, having a hole through its centre, as seen at T, fig. 6, of sufficient size to admit the axis or arbor, S, of the seconds' hand, 2, to pass through without touching it; the upper part of the arbor, S, where it rises above the surface of the fixed dial plate, W, is formed to a joint, upon which the seconds' hand, 2, has liberty to vibrate when it is required to make the nib, 2, touch the dial plate, W, in order to leave a mark or dot of colour thereupon, as before described. The arbor, *s*, has two small springs projecting from it, one on each side; the one marked 4 serves to bear up the nib, 2, and prevent it marking upon the surface of the dial, except when required; the other spring, 5, operates to make the nib, 2, strike suddenly upon the dial, and leave a mark or dot, in the same manner as the spring, *s*, described in figs. 1, 2, and 3; the seconds' hand, 2, has a small pin, 3, fixed in it, which pin projects downwards, and reaches near to the surface of the small round plate, formed at the end of the lever, T, as before mentioned; the star wheel, bent lever, &c. are the same as described in the other figures. The operation of the figs. 5 and 6 is as follows: suppose the seconds' hand to be in motion, and it is required to mark or note any precise moment, the button, *z*, before described in figs. 1, 2, 3, and 4, is pressed so as to move the star wheel, which, by the detent, *w*, raises the arm, T, and brings the surface of the small round plate up to the pin, 3, and raises the nib, 2, of the seconds' hand some distance from the dial plate, W, depressing the spring, *s*, until the point of the star wheel quits the end of the detent, *w*, at which instant the spring, 5, re-acts, and strikes the nib, 2, down upon the face of the dial plate, so as to leave a mark or dot of colour thereupon; the small plate at the end of the lever, T, would act equally upon the pin, 3, in every position of the seconds' hand. This construction of the instrument is only adapted to mark during 1 minute, without cleaning the dial plate from the previous dots or marks, in the manner before mentioned.

Having described the construction of the instrument in such manner as to enable persons conversant with such matters to put it in practice, it remains for me to state what I consider as constituting my claim, for I hereby declare that I do not claim the separate use of springs, star wheels, levers, or any other parts therein described or mentioned, but only as combined and applied in such manner as to form a new astronomical instrument or watch, which possesses the property of ascertaining and recording the precise moment of any desired observation or series of observations, by means of marks or dots imprinted upon a dial or plate, whether the same be effected by the dial or plate revolving, and the marking point remaining stationary, or by the marking point revolving, and the dial or plate remaining stationary; the spring barrel, wheel work, and escapement for the instrument, may be made in any way that may be thought adviseable. As I do not make claim to any of the watch or time-keeper movements, the form and proportion of the parts may be also varied, according to the discretion of the workman.

In witness whereof, &c.

Specification of the Patent granted to WILLIAM PONTIFEX, *the younger, of Shoe-lane, London, coppersmith and engineer, for new and improved modes of adjusting or equalizing the pressure of fluids or liquids in pipes or tubes; and also an improved mode of measuring the said fluids or liquids.* Dated July 1, 1824.

WITH AN ENGRAVING.

TO all to whom these presents shall come, &c. *Now know ye*, that in compliance with the said proviso, I, the said William Pontifex, the younger, do hereby declare that the nature of my said invention doth consist, first, in an improvement on an apparatus now in use for adjusting and equalizing the pressure of fluids, when flowing through pipes or tubes. This said improvement is of a self-acting nature, and is particularly adapted to effect the operation of adjusting or equalizing the pressure of inflammable gas, in flowing through pipes or tubes, for the purposes of illumination, since it would tend to maintain an equality in the pressure or velocity of the gas, when issuing from the jets or burners, so as thereby to maintain the flame of light proceeding from such burners at one uniform height, or nearly so, although the pressure of the gas in the conduct pipes or mains, which proceed from the gasometer or reservoir of supply, might vary considerably in its pressure from time to time. The apparatus may be supposed to be situated under ground, in any required part of the main, for which purpose its operative parts are entirely enclosed within a box or case, cast or otherwise, attached to the main; and in order to admit of a free action of the apparatus, the interior of the said box or case has a direct communication with the atmosphere through a pipe or tube, which proceeds to the surface of the ground; or the communication with the atmosphere may be formed in any convenient manner, according to the nature of the situation where the apparatus is employed. Secondly, in an improved apparatus for equalizing also the pressure of fluids in pipes or tubes, and which is particularly adapted to the operation of adjusting or equalizing the discharge of water, or other fluids or liquids, through a pipe or tube, although the pressure of water in the main or pipe of supply might vary occasionally in a considerable degree; and in which said improved apparatus a number of weights are applied, in such manner as to accumulate according to the resistance required. And thirdly and lastly, in an improved apparatus for measuring fluids, which apparatus performs the operation of measuring and registering the quantity of such fluids as may be caused to pass or flow through any pipe or tube, properly adjusted to the said apparatus, as hereinbefore more particularly described, by means of small gasometers, which are caused by an arrangement of valves and pipes, to move up and down alternately, in proportion to the quantity of fluid which passes through the apparatus. And in further compliance with the said proviso, I, the said William Pontifex, the younger, do hereby describe the manner in which my three several improvements may be performed, by the following description thereof, reference being had to the drawing annexed, and the figures marked thereon, that is to say :—

DESCRIPTION OF THE DRAWING. (See Plate I.)

And first, with reference to my said improvement on an apparatus now in use, for adjusting and equalizing the pressure of fluids when flowing through pipes or tubes : in figure 7, A represents a portion of pipe which is supposed to be united to the main, which proceeds from the gasometer or reservoir of supply aforesaid ; and B shows a continuation of the said pipe or main, proceeding to the burners or part where the combustion is supposed to be going on ; the middle of the pipe, A B, has a cylindrical projection or short branch, C, rising perpendicularly from it ; the upper edge or superior aperture of the branch, C, is covered by an inverted vessel, D *d*, and the lower edge or mouth, D D, of this vessel, is immersed in water, tar, or other suitable fluid, contained in a box or case, E E, which is cast upon or otherwise secured to the pipe, A B. This box has a lid or cover, *e e*, secured upon a flange at its upper part, so as entirely to enclose the inverted vessel, D *d* : F represents a pipe or tube, which communicates with the interior of the box, E E, and is supposed to proceed to the surface of the ground or otherwise, so as to afford a free access of atmospheric air to the interior of the box, E E, and consequently to the upper surface, *d d*, of the inverted vessel aforesaid. The inverted vessel is steadily guided by a projecting rod, *h h*, which slides through holes in stationary cross bars, *i i*, so as to admit of rising and falling in a perpendicular direction, with as little resistance as possible ; the lower end of the rod, *h h*, is bent sideway, and is affixed to a sliding sluice or valve, G, which is adapted to rise and fall along with the inverted vessel, D *d*, and by such motion to increase or diminish the aperture or passage of the pipe A B. This sluice, when fully open, descends into and is contained in the cavity C, which is formed for the purpose in the bottom of the pipe, A B ; the upper surface, *dd*, of the inverted vessel, is provided in the centre thereof with a chain, *m*, which is connected with an arched beam or lever, N; this lever moves upon a fixed centre or fulcrum at *n*, and is provided with a weight, *p*, suspended from a chain at its arched extremity, O. The object of the weight, *p*, is for the purpose of balancing in part the weight of the inverted vessel, D *d*, and causing it to remain just suspended, and in equilibrium. When the gas is at the regular required pressure in the pipe, A, the operation of the apparatus is as follows:—Suppose the gas to be flowing through the pipe or main from the gasometer, in the direction shown by the arrow, A, it will pass by the sluice, G, and proceed to the burners through the pipe, B, as shown by the arrow, B; but if the pressure of gas in the main at A should by any means be increased, the gas, by its elastic force, would operate upon the inverted vessel, D *d*, to raise the said vessel, in a certain degree, out of the fluid in which its mouth is immersed, and will thereby draw the sluice, G, (which is affixed to it as aforesaid) and diminish the area of the aperture through which the gas is obliged to pass in its way to the burners; thus, instead of the flames or lights being caused to burn higher by an increased pressure of gas, occurring in the mains or pipes of supply, they would be caused to maintain an equal height under such changes, in like manner; if a greater number of jets or lights should be turned on, they would, by requiring a greater supply of gas, tend to diminish the pressure in the mains or pipes of supply, so that the inverted vessel, D *d*, would descend in the fluid aforesaid by its own gravity, and would thereby lower the sluice, G, and open a passage of greater area for the gas to flow through, in order to meet the increased demand. This apparatus is adapted for very considerable variation of pressure, since the inverted vessel, D *d*, by being raised more out of the fluid in which it is immersed as aforesaid, will operate as an increasing weight, by displacing a less quantity of the said fluid; and as the counter weight, *p*, at the extremity, O, of the beam, N, is acting constantly with the same uniform weight, as a counterpoise to the inverted vessel, the same will be perfectly at liberty to rise and fall with very minute variations of pressure, which may happen to occur in the pipes or mains. And secondly, with reference to my said second improvement, being an improved apparatus for adjusting and equalizing the pressure of fluids in pipes or tubes as aforesaid, and hereinbefore described to be particularly adapted to the operation of adjusting or equalizing the discharge of water. Fig. 8, upon the drawing annexed, represents a section of my said second improvement: A represents the pipe, supposed to be proceeding from the pipe of supply or main; and B represents a continuation of the same pipe, which is supposed to proceed to the service or part where the water is to be discharged. This pipe is furnished, near the middle of its length, with a turning valve, G, and the upper part, A, of the pipe, A B, opens into a cylindrical box or vessel, C, which contains a bag or sack, *dd*, formed of leather or other sufficiently pliable material, which will prevent the escape of the fluid through its substance; the lower part or bottom of the said sack is attached to a moveable board or plate, D, which is capable of rising and falling freely in the vessel, C; the uppermost edge of the sack, *dd*, is secured by being screwed firmly between the top flange and cover, *ee*, of the vessel, C, so as effectually to prevent the escape of the water or fluid at that part, although the plate, D, is at liberty to rise and fall without obstruction, being guided and steadied in its motion by a small rod, *i*, sliding through a hole in the centre of the cover, *ee*. Over the top of this rod a pipe, F, is screwed, having a free communication with the atmosphere, and communicating with the interior of the sack, *dd*, by holes or apertures, *rr*, formed through the lid, *ee*, as will appear evident upon inspection of the fig. 8, upon the drawing. The turning valve, G, has an arm or lever, *k*, projecting from it, which is jointed to the lower extremity of a small connecting rod, *hh*, the uppermost end of which is jointed to the underside of the plate, D. By this arrangement, when the pressure of the fluid increases in the main and pipe of supply, A, from any cause, the plate, D, by such increase of pressure, will be caused to rise, and by its connecting rod, *h*, will tend to move the turning valve into the position shown by the dotted line in the figure, so as to diminish the aperture through which the water will be obliged to flow, in order to be discharged from the end, B, of the pipe; but as soon as the plate, D, has risen a short space, its upper surface will come into contact with the lowest of the suspended weights, *w*, which, by resting upon it, will operate to prevent it from rising higher, until still further increase of pressure occurs, when the plate, D, will continue to rise, and close the passage of the valve, G, until it meets with the second suspended weight, and so on throughout its whole range of motion, the suspended weight, *w*, producing the effect of an increasing resistance to oppose the rising of the plate, D, and thereby adapting the area or aperture of the turning valve, G, to the different degrees or variations of pressure, so as to maintain a sufficiently uniform discharge of water or fluid from the end, B, of the pipe, A B. The vessel, C, might be surrounded by an exterior vessel, as shown by the dotted lines, E E, and the vacant space, if desired, might be filled with any proper materials, to prevent the effect of frost upon the leather sack, *d d*. And, thirdly and lastly, with reference to my said third improvement, being an apparatus for measuring fluids or liquids by means of gasometers, having a reciprocating motion, as hereinbefore and hereinafter described. Figs. 9 and 10, upon the annexed drawing, will serve to explain a construction of the apparatus which is particularly adapted to the measuring of inflammable gas, for the purpose of illuminating. It consists of two inverted vessels or small gasometers, A and B, of a cylindrical or other convenient form, which are suspended by chains from the opposite extremities of a beam or lever, C, moving upon a centre or fulcrum, at *c*, in such a manner that the vessels, A and B, may be caused to reciprocate or move up and down simultaneously, but in opposite directions; the lower edges or mouths of the vessels, A and B, are immersed in water or other suitable fluid, contained in the vessels D and E. The whole apparatus is enclosed in an air-tight box or exterior case, F F, having an exit pipe or tube, H, proceeding from it, to the part where the gas is supposed to be burned or consumed. The gas, which is suffered to enter into this case from the main gasometer or reservoir, through the service pipe, G, by the particular arrangement of the apparatus, as will be hereafter described, must necessarily pass through one or other of the small gasometers, A or B, and in such manner as the said gasometers will, by the pressure of the gas, be caused to move up and down alternately, through a determined space or range. Thus, if the cubical content or capacity of the small gasometers, A and B, and the extent of their range or motion, is previously ascertained, it will only be requisite to know how many times the beam, C, has reciprocated, in order to ascertain or measure the quantity of gas which has actually flowed through the apparatus from the service pipe, G, to the exit pipe, H, aforesaid. The number of reciprocations which may have been performed by the gasometers, A and B, and beam or lever, C, is intended to be registered by a train of wheel-work, or other such contrivance as is usually employed for such purposes; and being sufficiently understood, it will not be necessary to give a description of it in my specification. The mechanism for effecting the register may, if desired, be wholly situated within the case, F F, having a glazed aperture in some convenient part, for the purpose of observing the dials or indexes of the said register. This glazed aperture I should propose to form in a circular ring of metal, adapted to screw into a socket fixed into the case, F F, opposite to the dials or indexes aforesaid, in order that access may be obtained to the apparatus in case of derangement. I will now describe the manner in which the gas is caused to enter and escape from the gasometers, A and B, at the proper intervals, to produce the desired effect. The service pipe, G, is formed withinside the case, F F, to a double branch, which enters the sides of the vessels, D and E, and turns up beneath the gasometers, A and B, as shown at *h* and *i* in the figures; the upper extremities of the pipes, *h* and *i*, rise some distance above the surface of the fluid contained in the vessels, D and E, and are furnished with valves, marked 6 and 7 in the figure: *d* and *b* represent two other pipes, the upper extremities of which rise above the surface of the fluid in the vessels, D and E, and are provided with valves, marked 5 and 8, similar to those last mentioned. The pipes, *a*, *b*, proceed to the bottom of the vessels, D and E, where they turn sideways, and open directly into the box or case, F F; the valves aforesaid are connected together in pairs, by small levers or beams, *m* and *n*, in the following order, viz. the valves 5 and 6 forming one pair, and the valves 7 and 8 forming another pair, the levers and beams, *m* and *n*, being adapted to move or vibrate upon centres or fulcrums in the middle of their length, which centres are supported upon brackets or standards, o, affixed to the upper extremity of the pipes, *h* and *i*. By this arrangement the corresponding valves, 5 and 7, and those 6 and 8, are caused to open and shut with a simultaneous movement; the said valves are caused to move at the proper intervals by the operation of small studs or projections, *q*, *r*, *s*, and *t*, which are formed on the sides of the rods or wires, *x* and *y*, attached to the upper part of the gasometers, A and B. These studs, *q* and *r*, *s* and *t*, do not operate directly upon the valves, but they are caused to operate upon small balance levers, *k* and *l*, which are made hollow, in the form of trunks, and contain a portion of mercury or other ponderous fluid, the object of which will be hereinafter explained. These balance levers are adapted to vibrate freely upon the same centres of motion as the levers, *m* and *n*, but with the liberty of moving through a certain space, independently of the levers, *m* or *n*. The operation of the apparatus is as follows: Suppose the gasometers, A and B, to be in the position represented by the figure 10, the gas is supposed to be escaping from the exterior case, F F, to the burners, through the pipe, H; the valve, 6, being open, the gas will flow through the service pipe, G, and branch, *h*, into the gasometer, A, and will cause it to rise at the same time the valve, 8, belonging to the gasometer, B, is open; thus the gasometer, B, will descend, and force the gas which was contained in it to escape through the pipe, *b*, into the exterior case, F F, the valves, 5 and 7, being shut or closed, as shown in the figure. The direction in which the gas is flowing, and the direction in which the gasometers are moving, are indicated by the small arrows, in fig. 10. In this position the projecting studs, *r* and *s*, before mentioned, are supposed to have come into contact, at the same instant, with the ends of the balance levers, *k* and *l*, and to have moved them upon their centres or fulcrums, in a sufficient degree, to cause the fluid contained within them, as aforesaid, to flow to their opposite ends, as shown by the dark shade, in the fig. 9, by which means, the ends to which the metal has flowed will preponderate, and by coming into contact with the elevated extremity of the small levers, *m* and *n*, will force them suddenly downwards, so as to change the position of the valves, as shown in the fig. 9, upon the drawing. In this situation the gas will flow from the service pipe, G, through the pipe, *i*, and valve, 7, into the gasometer, B, so as to cause the same to rise, and allow of a corresponding descent of the gasometer, A, the gas from which will escape freely through the valve, 5, and pipe, A, into the exterior case, F F. This action will continue until the projecting studs, *q* and *t*, which are affixed to the gasometer by the wires, *x* and *y*, as aforesaid, have come into contact with the balance levers, *k* and *l*, and have moved their extremities sufficiently to cause the fluid metal conused previous to the date of the said hereinbefore in part recited letters patent, be it therefore known, that I do not claim the parts in fig. 7 of the drawing annexed, marked D D, *d d*, *m*, N, *n*, *o*, and *p*, as my invention; neither do I claim any right of exclusive privilege to the same, in conjunction with my said improvement; but only to those parts of the fig. 7 which, in the drawing annexed, is represented by shaded parts, having represented the other parts of the said fig. 7 merely for the purpose of better explaining the application of my said improvement, to the purpose last aforesaid; and a valve or sluice, such as is represented by the shaded parts, in fig. 7, of the drawing annexed, for the purpose last aforesaid; and also an improved apparatus, for the purpose last aforesaid, such as described at fig. 8, in the drawing annexed, and which is hereinbefore described as particularly applicable to the operation of adjusting or equalizing the discharge of water or other fluids, or liquids through a pipe or tube; and also an improved apparatus for registering and measuring the quantity of such fluids as may be caused to pass or flow through any pipe or tube, by means of gasometers having a reciprocating motion, such as is described by figs. 9 and 10, in the drawing annexed, being, to the best of my knowledge and belief, entirely new, and never before used in that part of his Majesty's kingdom of Great Britain and Ireland, called England; his said Majesty's dominion of Wales, and town of Berwick upon Tweed; nor in any of his said Majesty's colonies or plantations abroad. I, the said William Pontifex, the younger, do hereby declare this to be my specification of my said invention, and that I do verily believe this, my said specification, doth comply, in all respects, fully, and without reserve or disguise, with the proviso in my said hereinbefore in part recited letters patent contained, wherefore I do hereby claim to maintain exclusive right and privilege to my said invention, as hereinbefore set forth.

In witness whereof, &c.

Specification of the Patent granted to William Yetts, *of Great Yarmouth, in the county of Norfolk, merchant and ship owner, for certain apparatus to be applied to a windlass.* Dated February 28, 1824.

WITH AN ENGRAVING.

TO all to whom these presents shall come, &c. *Now know ye*, that in compliance with the said proviso, I, the said William Yetts, do hereby declare the nature of my said invention to consist in securing the forward end of a lever bar, such as is hereinafter more particularly mentioned and described, by means of a perpendicular and diagonally supported standard and bearing, which constitutes a part of my said apparatus; and also in an additional pall, placed shaft, and lying against and partly round the windlass barrel, and acting upwards from the deck, which constititutes the remaining part of my said apparatus. And in further compliance with the said proviso, I, the said William Yetts, do hereby describe the manner in which I perform my said invention, by the following description thereof, reference being had to the plate annexed, and figures marked thereon, that is to say;

DESCRIPTION OF THE ENGRAVING.

Fig. 11 (Plate I) is a perspective view of a ship's windlass, with my said apparatus applied thereto: B is the lower part of the safety pall, fastened through the deck to a beam under it, and moving with a joint at *e*: C is the upper part of the safety pall, moving on a joint at *f*. These two parts of the safety pall are kept to their place against, and partly round, the windlass barrel, by means of a chain, s, which, in order to allow of the necessary play for the motion of the palls over the ratchets, is attached, at one end, to the flat spring, *g*, which is fixed to the pall bit, as shown in the figure: *r r* are ratchets on one side of the ordinary cogs on the windlass barrel: there are a similar set of ratchets on the other side of the cogs, but which, in this view, are hid by the rim or flange, x, On the under side of each part of the safety pall are teeth, which take into the ratchets, *r r*, and thus assist the ordinary palls of the pall bit, in preventing the windlass from revolving in a direction forwards: X X are rims or flanges, raised on each side of the ratchets, *r r*, for the purpose of keeping the two parts of the safety pall in their proper place; *t t* are the bottom parts or feet of the perpendicular standard, described more particularly at fig. 15. Fig. 12 represents a perspective view of the said safety pall, showing the teeth or catches, L L, which take into the ratchets, *r r*, fig. 11. Fig. 13 represents a section of the windlass barrel, showing the form of the ratchets, *r r*, and their relative positions with respect to the ordinary cogs of the barrel, as also the rim or flange, X X. Fig. 14 represents a section of the windlass barrel of the said safety pall, and of the ordinary palls of the pall bit; and this figure is given for the purpose of describing the manner of setting the safety pall for use, which is as follows (that is to say), the safety pall being only intended to act for the purpose of resistance, when a more than ordinary strain is brought upon the ordinary palls, the teeth of the safety pall should be set about one-eighth of an inch clear of the ratchet opposed to it, when the ordinary pall bears close against its corresponding cog; then, when any extraordinary pressure against the ordinary pall bit causes it to spring off, the safety pall takes against the ratchets, and adds its resistance to the ordinary palls: *e e*, in this figure, are the ordinary half palls; *m m m* are the ordinary palls, in their resisting position: B and C are the two parts of the safety pall, at the distance of one-eighth of an inch from their corresponding ratchets. Fig. 15 is a representation of a section of the windlass, showing that part of my said invention which refers to the forward end of the lever bar: H is the lever bar, passed through one of the handspike holes, in a horizontal position, the after end, P, being retained by a long hook bar going into an eye bolt in the deck at the end, N, and swinging on an eye joint at the end, P. The part marked O is to represent the perpendicular handspike hole, corresponding with the horizontal one which intersects it. Now, so far as this fig. 15 is hereby described, I do not claim any novelty or exclusive privilege; but only in the parts hereinafter described, as follows, (that is to say:) O is the forward end of the lever bar, which it will be seen enters into the bearing, R, which is supported from the deck by the perpendicular standard, W, and which standard is supported in turn by the diagonal bar, D, which is fastened to the deck at F. These standards and bearings, and the diagonal bar, as also the safety pall, I make of cast iron, and of the proportions represented in the plate annexed, the size of course varying with the size of the windlass. Now whereas I am the true and first inventor of the whole hereinbefore described lever bar and long hook bar, as shown in fig. 15, and, in fact, of the mode obtained thereby of preventing the windlass from revolving in any direction; but whereas I have published heretofore, and have allowed the public use of so much of the said lever bar as is described by the letters H P and N, I therefore do not claim exclusive privilege to that part thereof. But such a bearing and standard as aforesaid, for securing the forward end of the lever bar, and such a safety pall as aforesaid, placed abaft the windlass, and acting upon it upwards from the deck, in manner and form aforesaid, being, to the best of my knowledge and belief, entirely new, and never before used in these kingdoms, I do hereby declare this to be my specification of the same; and that I do verily believe this, my said specification, doth comply in all respects fully, and without reserve or disguise, with the proviso in my said hereinbefore in part recited letters patent contained, wherefore I do hereby claim to maintain exclusive right and privilege to my said invention.

In witness whereof, &c.

OBSERVATIONS BY THE PATENTEE.

The patent apparatus has been submitted to the inspection of the Commissioners of his Majesty's Navy, upon whose report the Lords of the Admiralty gave immediate orders for the fitting of the Surly, the Swan, and the Basilisk cutters.

It has also been inspected by the Committee of the London Ship-Owners' Society, as well as by some of the most respectable and experienced ship-owners, ship-masters, &c., at the port of Great Yarmouth, who have expressed their unqualified approbation of the invention, and from whom the patentee has been honoured by the most flattering and satisfactory testimonials.

The apparatus, which consists of bar-standards, lever-bars, and a safety-pall, combines neatness in appearance, with simplicity of construction, and is not in the least degree cumbersome.

The properties peculiar to the bar-standards and lever-bars are, that they render the windlass, at the time of riding at anchor, a perfect fixture. Their power over the windlass prevents the possibility of its bending or yielding, in any direction, to the strain of the cable, and wholly relieves the palls and windlass-bits from pressure; consequently, the inconvenience so frequently accruing from a straining of the seams at the deck, may be, by these means, entirely prevented. The lever-bar may be shipped or unshipped instantaneously.

The safety-pall is calculated to relieve the fore-palls from excessive pressure, and which not only affords effective security to the windlass, whilst riding, but it also imparts that security at the time of heaving; for, were it possible that all the fore-palls could give way, the safety-pall would most effectually prevent the windlass from flying round; added to which, its peculiar construction renders it impossible to be upset, even when heaving against a head sea: neither does it occasion any impediment to the required rotatory motion of the windlass, and may be fixed or unfixed with the greatest facility.

The daily recurrence of the loss of lives and property, occasioned by windlasses giving way, renders it superfluous to descant on the great advantages to be derived from the adoption of the patent apparatus; it is however to be hoped, that this invention, so pre-eminently calculated to avert the frequency of mischief, from the upsetting of palls, at the time of heaving, may be considered by those conversant in nautical affairs, as an attainment of a most important desideratum, in regard to the construction of the windlass.

Particular attention should be paid in fixing the barrel upon the body of the windlass, for on that greatly depends the proper action of the safety-pall. To do this effectually, place a stool or trestle the exact height of the centre of the after-part of the windlass, on which lay a piece of board, broad enough to extend across the ratchets on each side of the barrel within the flanges, in order that the barrel may be adjusted by the passing of the ratchets against the piece of board.

Observe that, on each safety-pall is inscribed the height of the windlass, from the centre to the deck amidships, to which it is adapted; but, should circumstances require the windlass to be fixed higher than what is inscribed on the safety-pall, it will only be requisite to elevate the deck-plate by means of a small chock. Let the teeth of the safety-pall be set about one-eighth of an inch clear of the ratchets opposed to it, when the ordinary pall bears close against its corresponding cog. To effect this—place a piece of spline, one-eighth of an inch thick, extending to the face or flat surface of a ratchet on each side, for the lower teeth of the safety-pall to hang upon; then—proceed to fix the deck plate, and bore the holes for the deck bolts, which must be done with great exactness, in order that, when the shackle bolt be shipped, the safety pall may lay even against the barrel.

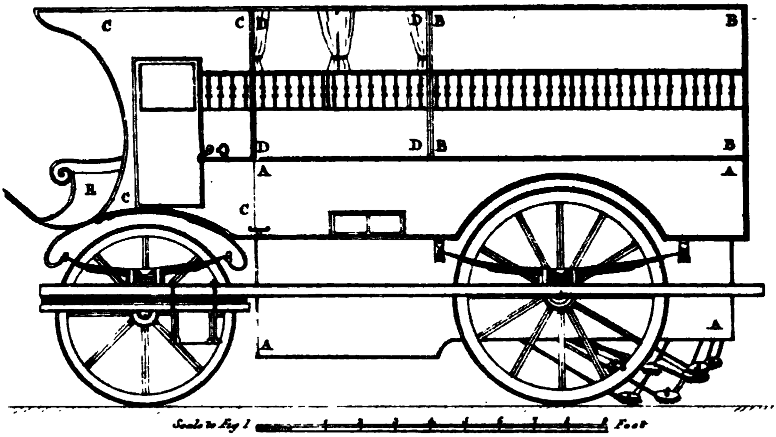
The spring box must be morticed into the pall bit a sufficient depth to admit of the plate (which is intended to secure it from the weather), being nailed on flush with the pall bit. The bottom of the spring box must also be fixed as close as possible to the upper part of the pall plate.

adapted to receive four inside passengers, or four passengers of the first class; and the part, D D D D, is adapted to receive twelve outside passengers: E represents the conductor's seat, which is situated in front, so that he may be capable of looking out clear over the road which the carriage is to travel. The conductor is also supposed to possess a controul over the entire machine, by having rods or cords coming to him from all such parts as may require attention; and by the whole carriage, machinery, and all being mounted or suspended upon springs upon the bed or part to which the wheels are affixed, the motion would be very easy. Figs. 2 and 3 upon the annexed drawing will serve to explain the mechanism for propelling the said locomotive carriage forwards, upon a rail-way or a common road: F represents the main crank axis, which in the drawing is supposed to have eight cranks formed out of it, each of which said cranks has a rod or propeller jointed to it, similar to what is represented at G. These propellers I construct of metal, and make them hollow, in the form of tubes, so as to contain a wooden rod within the tubular part thereof. The outermost extremities of the propellers are secured to arched pieces of metal or feet, *g*, the curve of which arcs is performed by a radius, about equal to the radius of the cranks, F; and the under surfaces of the curves or feet are shod, according to my improvements, with pieces of cork, short hair, whalebone, or other suitable material, set on end like a stiff hard brush; the said substances to project a short distance beyond the points or extremities of iron teeth. Thus, if the flexible material should yield in any considerable degree, the points of the iron teeth aforesaid would come into contact with the ground, and would act as propellers to advance the carriage forwards.

During the winter, when the surface of the ground is covered with ice, or hard snow, I intend to furnish the under surfaces of the said curves, or feet, with steel points, which may project sufficiently to seize the ground and propel the carriage forwards. The uppermost parts of the curves, or feet, *g*, are loaded with lead, or other ponderous material, in order to render them sufficiently heavy to operate in a proper manner upon the ground. The extreme ends of the propellers are formed on the upper surface to a joint or knuckle, *h*, and have slight metal rods, H, jointed to them, which said rods proceed upwards, and are attached to the extremities of a number of arms or levers, I, moving upon a fixed centre at K. The levers, I, are guided in their motion sideways by sliding through openings, or slits, in a kind of curved grating, *l*, *m*, and they have a small pulley, or roller, *n*, working into a grove, or mortice, in a projecting piece from the under side of each lever. The small rollers, *n*, are adapted to bear upon the upper surfaces of the shapes, or excentric wheels, L, which said wheels are mounted upon an axis, or shaft, M, turning in bearings supposed to be screwed to the carriage frame. The main crank axis, F, is furnished with a cog-wheel, *f*, at each end thereof, as seen at *f f*, in fig. 3; one of which wheels is represented at *f*, in fig. 2, by a dotted circle only; this wheel communicates motion to another cog wheel, of equal diameter and number of teeth, fixed upon the end of the excentric wheel shaft, M. Thus both the said shafts are caused to revolve with equal velocities, and the shape or situation of the curves, or excentric wheels, is such, that the levers I, by the aid of the rods, H, are adapted to allow the under sides of each of the propelling feet, *g*, to remain upon the ground during the motion of the crank from No. 1 to No. 8, and then to raise the feet, *g*, up from the ground by the excentric part of the wheels, L, from No. 8, by No. 7, to No. 6, each of the feet remaining clear of the ground, from No. 6 to No. 2, and then descending at the part from 2 to 1; by this means, as there are eight cranks represented in the drawing by the figs. 2 and 3, so there would be eight propellers, G, and eight rods, H, with their levers, I, and excentric wheels, L, which, by operating in a regular succession, would tend to produce a continuous and uniform action upon the carriage to propel it forwards, the cranks being so arranged relatively to the propellers that the said propellers may come upon the ground, first on one side of the centre line of the carriage, then upon the opposite side of the centre line, thereby avoiding any degree of side motion or riggling of the carriage along the ground; and in order that the cranks may be sufficiently stiff, I propose to insert a support or collar between every pair of cranks, as will appear evident from inspection of the parts, *q q*, fig. 3. Each of the propellers, G, will be guided in its motion sideways, by working through a groove or slit formed in the lower part or bottom piece of the hinder part of the carriage, as represented by *o p*, in fig. 2. They will each of them have a line attached to it, being conveyed over pulleys along the uppermost part of the carriage to the conductor, in order that he may arrange the working of the same according to the nature of the road over which he has to travel, or in turning round a corner; this latter movement of raising up some of the propellers from the ground will act very conveniently along with the simple turning of the front wheel of the carriage. I should at the same time recommend that the wheels were each provided with a gripe or break, the handle of which were within the power of the conductor, so that he might descend a hill without difficulty or risk; and in travelling up hilly ground it will be found very advantageous to have transverse pieces of wood, or other sufficiently hard material, disposed across the breadth of the road, between the lines of rail-way, the said pieces being placed at about five or six inches asunder, as may be found most convenient for the feet of the propellers to act against in propelling the carriage. The aforesaid mechanism will be found equally applicable to the propelling of ploughs, harrows, or other agricultural machines or implements; but the feet of the propellers will require to be made larger in proportion as the machine is intended to travel over uneven or soft ground.

I have now described, with reference to the annexed

Fig. 1.



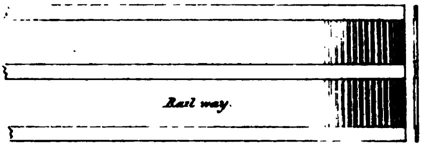


Fig. 3.

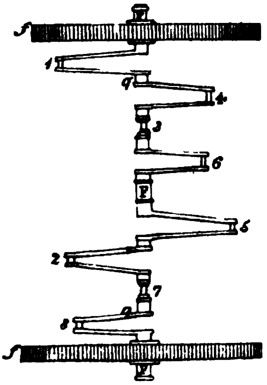


Fig. 2.

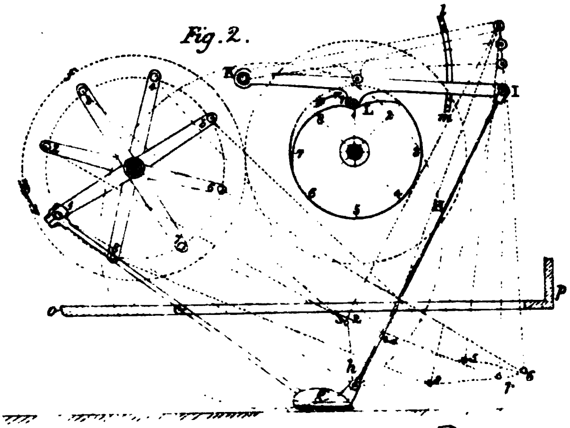


Fig. 4.

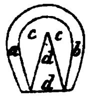


Fig. 5.

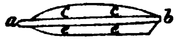


Fig. 6.

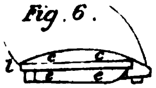


Fig. 7.

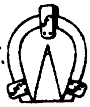


Fig. 8.

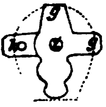


Fig. 9.

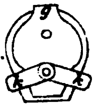


Fig. 10.

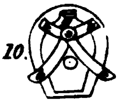
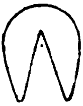


Fig. 11.



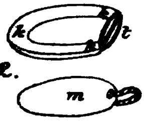


Fig. 12.

Fig. 13.

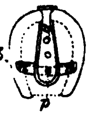


Fig. 14.

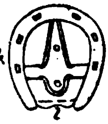
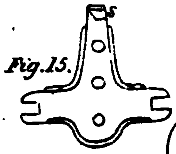


Fig. 15.



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drawing, my invention of certain improvements in the construction of carriages or other machines, to be moved or propelled by mechanical means, and I do hereby declare, that I confine my claim of invention to the following particulars, viz. First, the general arrangement of the machinery or apparatus for propelling by mechanical means carriages, ploughs, harrows, or other agricultural machines or implements as hereinbefore described, with reference to the annexed drawing. Secondly, I claim the exclusive right of having the rods or propellers in such carriages, or machines, jointed to cranks situated at different angles upon the same axis, so that the extremities or feet of the propellers will act upon the ground in succession, at a time when they are moving with the greatest velocity, or nearly so. Thirdly, I make claim to the curved form of the under surfaces of the feet of the propellers, being described by a circle of about the same radius as the radius of the cranks which move them, in order that the said feet may accommodate themselves more easily to the ground, and especially in the act of turning. And fourthly, I claim the right of employing bristles, whalebone, or other pliable material affixed to the under surface of the curved feet of the propellers, as a substance to come into contact with the ground, and hold sufficiently thereupon.

The form and proportion of the various parts of the apparatus constituting the mechanism aforesaid, must be varied according to the circumstances of the case, without departing from the object of the invention, as hereinbefore described and set forth.

In witness whereof, &c. &c.

OBSERVATIONS BY THE PATENTEE.

Until a better moving power shall be obtained, I propose to use a high-pressure steam engine, with two cylinders, so as to dispense with a fly-wheel, the boiler of which I recommend to be on the American principle of multiplied coils of small copper tube; thus affording a light and a large surface for the fire to act upon in a small space, in which case no possible danger from bursting could arise. The water to be forced down a pipe along the flue, and the steam to come out below, at the hottest part of the tube. Rain water to be used; and to save it and the heat as much as possible, the exit pipe from the steam engine ought to be inserted 6 or 8 inches into the water cistern; the end of the pipe to be like the rose of a watering pan, the orifices of which to be small tubes about an inch or two long, the sum of the area of which to be equal to the area of the exit pipe. By this means there would be little waste of water, and it could be pumped back into the boiler so long as the water in the cistern can be kept under the boiling point of water in vacuo.* In some degree this arrangement would make the engine a condensing one, and at no time would the pressure on the exit steam be an impediment worth consideration. Although my locomotive carriage is adapted for common roads, and for ploughs, harrows, &c. yet it is upon rail-roads, ice, and snow, that the greatest advantage would be gained, and where the rapidity would be immense. The rail-road represented in the plate is intended to be made of wood, and that part of it upon which the wheels are to move ought to be covered with very thin sheet iron. Even in this country such a species of rail-road would not be expensive; but in some parts of Europe, Russia, and America, it would cost less than a well-made common road. The stumps of trees, in fact, would in general be all the foundation required. The following are the principal uses to which I think the locomotive carriage above described might be put:—

1st. To propel carriages on common roads or fields.

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* This species of boiler and cistern I recommend for steam vessels on long voyages, and where the cistern could always be kept at the required low temperature, by surrounding it with a plate of sea-water. To keep the cistern in a locomotive carriage cool, a stream of air might be employed.

2d. To propel ploughs, harrows, &c.
3d. To propel carriages on rail-roads.
4th. To propel carriages upon skates on snow and ice.
5th. To propel carriages over hot sandy deserts; and
6th. To propel warlike carriages.

In the three last cases the passengers, engineer, and guide, would be protected from cold, heat, and warlike missiles.

To such persons as may be disposed to try my invention I will be happy to give every facility and information in my power.

Specification of the Patent granted to ROBERT DICKINSON, *of Park-street, Southwark, Surry, Esq. for an improvement in addition to the shoeing or sloping and treatment of horses' feet.* Dated Aug. 5, 1823.

WITH AN ENGRAVING.

TO all to whom these presents shall come, &c. &c. *Now know ye*, that in compliance with the said proviso, I, the said Robert Dickinson, do hereby declare that the nature of my said invention, and the manner in which the same is to be performed, are particularly described and ascertained as follows, that is to say:—It consists in the formation or construction of peculiar implements, which I call resters, and in the application of the same to the feet of horses, for the purpose of supporting them, and producing ease and comfort to such animals, as well as for promoting the healthy state of their feet, by affording them protection, and maintaining a proper degree of moisture; and likewise of certain additional parts to be used in the shoeing of horses for work, as hereinafter described. In all the ordinary constructions and applications of horses' shoes, the iron shoe is so placed and fixed to the hoof, that the whole weight of the animal, when standing, bears upon the outer edges of the sole, and the frog, or tough elastic central part of the foot, which nature evidently intended should bear a portion of the weight, is raised and removed altogether from contact with the ground. By this means one of the most considerable members of the foot is thrown completely out of action, and the whole weight of the animal is suspended or hung (as it were) upon the crust or front circumference of the hoof. The proper distribution of pressure upon the foot, by throwing a portion of it upon the frog and sole, is very generally admitted; and it is a want of proper attention to this circumstance, that produces some of the disorders to which the feet of horses are liable. The principal objects of my invention are, therefore, to produce this pressure on the frog and sole; to make its quantity variable, according to the exigency of the case; and to maintain such a proper quantity of moisture at all times upon the foot, as shall prevent its growing hard and cracking, and as shall insure the healthful expansion and growth of its parts. To produce these desirable ends, I use the apparatus or implement shown, flatwise, or in plan, at fig. 4, (Plate II.) and in section; or, as it would appear, if cut through longitudinally, at fig. 5; its size, form, and dimensions, varying with that of the foot to which it is to be applied, or the exigencies of the case; and this apparatus I call a rester. It consists, in the first place, of a base or stiff piece of material, *a*, *b*, for the purpose of giving strength and consistence to the apparatus; and on this account I form it of thick buff or tanned leather; carpet, or woollen cloth painted on one side; felt, such as is used for hat making; canvass, stiffened or strengthened by painting, varnishing, or cement; or tarpaulin or floor cloth, or any similar materials that will bend, so as to permit its introduction into the shoe, and yet is sufficiently rigid or stiff to maintain its place when once put in. To the upper part of this base, or that which goes next to the horse's foot, I sew, stitch, or otherwise attach and fix, two pieces of sponge, thick and porous felt, sheep's skin, tanned with the wool upon it, or other soft elastic and absorbent material, as at *c c*; or else I form the whole of one piece, in which case the triangular portion, *d d*, must be cut out and removed, so as to make room for the frog of the foot to enter it, and bear upon the base of my apparatus. The projecting pad, *c c*, formed as aforesaid, must fill up the whole sole and hollow of the foot, and surround the frog as nearly as possible; consequently, it will require more or less projection, according to the depth of the foot to which it is applied, and which it should fit as neatly as possible, its intention being to retain water or any other fluid with which it may be moistened in contact with the foot, and thus to keep it in a damp state as long as may be required. To the underside of the said base, *a b*, or that side which is next the ground, I also sew or otherwise attach a pad or cushion, *e e*, fig. 5, which must be of such size as to be contained within the opening of the horse shoe, and of such thickness as to exceed that of the shoe, or its elevation above the ground; consequently, whenever the foot is put to the ground, the bottom of this lower pad, *e e*, will come into contact with it, and will receive the pressure, which will be transferred to the base, *a b*, and from thence to the frog and sole of the horse's foot. In order to apply these resters to horses' feet, the stiff projecting edge of the base, *a b*, is to be introduced into the hollow space that occurs between the arch of the sole of the horse's foot, and the top surface of the shoe, as shown in fig. 6, which is a general section of the horse's foot, with the shoe and the rester applied within it. In some cases where, from want of space between the shoe and the foot, or other cause, it may appear desirable to use a base or middle piece, *a b*, of little rigidity or stiffness; as, for instance, when it is made of hat felt, I then cause small metal projections, such as are shown at *f f f*, in fig. 7, to be rivetted upon such sole, their length being just sufficient to take sufficient hold of the inside of the shoe, to hold the rester in its proper place; and in other cases, particularly in disordered feet, when it may be desirable to remove and replace the rester frequently, I make use of the holdfast of thin plate iron, or other metal, shown in different forms, at figs. 8, 9, and 10, in which the fixed points, *g*, *g*, pass between the foot and the iron shoe; while those at *k*, *k*, are moveable upon the rivets *i*, *i*, as centres, and may be turned backwards and forwards to remove or fix the rester at pleasure. In some cases likewise, instead of attaching the pads, *c*, *c*, fig. 4, to the base *a*, *b*, I make them of the same materials as aforesaid, but loose and detached as at fig. 11; and in this case, after causing them to fill up the hollow of the foot fully and properly, I introduce a base, either with a stuffing or padding of uniform thickness, or without any padding or stuffing at all, on the inside, and I fix and attach it by any of the means aforesaid. All the above described apparatus, it must be understood, is required to be applied only to horses in the stable, and not when they are at work. In order to meet and give support and pressure to feet of the greatest depths, I form a double bag, that is, a bag with a division or partition between the two sides, with a strong, stiff, projecting edge, rendered so by paint or varnish, see *k*, *k*, *k*, fig. 12; which rim or margin is for the purpose of passing between the foot and the shoe, to hold the apparatus in its place as aforesaid. The mouths or opening of these bags or pockets are at the heel, and by these I introduce first a sufficient quantity of packing or stuffing of sponge, felt, wool, shavings of leather, or other soft absorbent and elastic materials, either to fill up the hollow of the foot, and to produce the requisite pressure and moisture; I then introduce into the lowest pocket or division, or that next the ground, a small pallet or piece of wood, leather, or other sufficiently hard substance, cut into the form shown at *m*, fig. 12, or else I fill such pocket or division with shavings of leather, bits of rag, hay, or other substances, until I have produced the necessary pressure upon the frog; when the wooden or other pallets, or paddings, *m*, fig. 12, are made use of, it will be necessary to have them of different degrees of thickness, in order to suit different depths of feet, and make them project beyond the shoe: another means which I make use of is shown at fig. 13; it consists of an artificial frog of iron, or other material, *p*, *q*, having a spring of steel or hammered iron, fixed transversely across it, as at *n*, *o*, *n*, the ends, *n*, *n*, of this spring go between the shoe and the foot; and as the spring itself is arched or bent upwards, having its ends inclined towards the shoe, and is fixed to the artificial metal frog, *p*, *q*, it will of course bear that artificial frog upwards against the real frog of the horse's foot with a degree of strength or pressure, equivalent to the power of the spring, which of course may be made greater or less at pleasure, by the application of the aforesaid inventions, or such of them as are most suitable to the particular case, it will be seen that a much more efficient stopping of the foot pressure on the frog and sole, and application of moisture, are obtained than by any of the means now used for such purposes; I not only, however, extend my invention and improvements to horses' feet when in the yard or stable, but likewise apply it to them when at work, by the following means: In the first place, having prepared and cleaned the foot, and put it into a proper state for receiving the shoe as usual; if the foot is very hollow, and I find it expedient, I stop round the frog and fill up the hollow of the horse's sole with a detached padding, so thick as will make it nearly level when the shoe with its appurtenances is put on, and this is best formed of sheep skin, tanned or tawed with the wool on it, and attached either simply to the iron frog before mentioned, by rivetting, or stitched at its margin to a piece of cloth, strong leather, or other material, to give it stiffness and protection, and in which I form a pocket, if necessary, wherein to introduce stuffing as before described, for the purpose of filling up a more than usually great hollowness of the foot, in which case the iron frog is to be fastened by rivetting, or otherwise to the under material or piece of cloth as before described, or to a piece of thick felt, painted canvas, or any of the strong substances hereinbefore named, as proper for making the base, or any other substance which may be fit and proper for the purpose. This must be cut to the exact form of the external edge of the foot, as shown at fig. 13, and I then strengthen or protect the under side of such piece of material by an artificial frog, or centre piece of iron or other material, either with or without the spring, *n*, *n*, shown in fig. 13. This metal plate, or artificial frog, is to be fastened with rivets, having wide washers, or plates, to render them more secure, to the said piece of material; and having, if necessary, first stopped and prepared the foot as aforesaid, I next place the piece of material, so cut out and protected, over the same, and then apply the shoe over this, as shown by the dotted line in fig. 13, and nail it to the hoof in the usual manner, when the nail will pass through the said piece of protected sheepskin, leather, or other material, which will thus be firmly attached to the foot, and will be immoveable until the shoe is removed. The foot and shoe, when so prepared and finished, will have the appearance shown in fig. 14, when viewed from the under side. In a foot so prepared and shoed, it is evident, that any required degree of pressure, or none at all, may be produced at pleasure, by adopting the spring shown in fig. 13. It will also be evident, that from the absorbent nature of the materials, or stopping, introduced into the hollow of the foot, it will always be kept moist, from which the most beneficial results may be expected. I likewise occasionally turn down the edges of the metal plate, or false frog, *p q*, figs. 13 and 14, not only to give it greater strength, but because it is an excellent preventive against slipping. This artificial frog might be made in one piece, as at fig. 14, or as shown detached from the shoe at fig. 15, having a hooked point at *s*, which may be used or not; but by making them in two, and rivetting them together, as at fig. 13, the substance and strength of the spring, or the depth, shape, and substance of the frog, may be suited exactly to the exigency of the case. Lastly, I declare, that although I have described the various forms, or shapes, of the several parts of my invention and apparatus, and the materials of which I conceive they are best made and constructed, yet, as my invention does not consist of these alone, I do not confine myself to them, inasmuch as it may be necessary to vary them to suit particular cases. The essence of my invention, and the only part of the same which I claim the whole and exclusive right and benefit of under my aforesaid hereinbefore in part recited patent, is the apparatus last above described, namely, the artificial frog of iron, or other metal, with or without a spring, and the soft and elastic packing of sheepskin, with the wool upon it, or other fit material, as hereinbefore mentioned; and I therefore claim the use of all such materials as possess the requisite properties of retaining moisture, and protecting and assisting the foot when used and applied in the manner described by figs. 13, 14, and 15; that is to say, when used and nailed upon the foot, in conjunction with the shoe as aforesaid. The varnish before alluded to, which I make and use, is formed of five ounces of shell lac, with one ounce of turpentine, and 32 ounces of alcohol; and the paint which I prefer is that known by the name of Ribblesdale's rock cement, when mixed with common oil paint.

In witness whereof, &c. &c. &c.

Description of a simple apparatus for lifting heavy goods from the ground into carts or waggons. By Mr. J. W. Boswell.

Communicated by the Author.

It has often appeared to me, that society would be much benefitted by communications published relative to useful matters, which may have occurred to individuals in their several pursuits or employments, and which, from various circumstances, they may not be able to render lucrative to themselves by the exclusive right of a patent, or other means, though valuable for their application to purposes of acknowledged utility.

Influenced by this opinion, I have communicated several papers, which appeared to me to contain matters of this description, for publication at various times, and should have transmitted others, but have been prevented partly from the pressure of my business, and partly from considerations with which it is not material to trouble your readers.

Some of these I have had the satisfaction to see adopted by gentlemen who had more opportunity to turn them to practical utility than I had. One gentleman, who made use of my improvements on the Schemnitz Engine for Raising Water, has had the liberality to acknowledge his having taken his ideas from my paper relating to it in Nicholson's Philosophical Journal, in what he published respecting this matter. And another gentleman has done me the honour to take out a patent lately for my Method of Moving Ships by Compressed Air, which was published in the Number of the Repertory of Arts for April, 1815; which, however, I presume, cannot be of much use to him, as, by this publication, I have not only established the priority of my claim to the invention, but of course have rendered his patent null and void.

These two instances will, I hope, give some proof of what I have asserted relative to the value of such publications, and excuse me for again taking up some more of your pages with similar communications.

Having had occasion, some time back, to send off several large cast iron vessels, some of which weighed considerably more than a ton weight, and not being provided with a crane to lift them into the cart, I had to contrive some method for the purpose, less expensive, troublesome, and dangerous, than the united efforts of a number of men.

I had some deal spars, a few planks, and some strong cord that had served for binding pearlash casks, but nothing else that could be at all applied to the use desired; with these, however, I made a shift to construct an extemporary apparatus, which I found extremely convenient for my design, very simple, easily put together, and of no cost; and which, as others may find it, or one of a similar kind, equally serviceable, I will describe at large.

With three of the spars I erected what is commonly (though improperly) called a triangle, united by cords together at top, and diverging sufficiently at bottom to make it steady; to the top of this I fastened, by several rounds of rope, a strong beech plank by the middle, placing it edgeways, (or with its plane vertical to that of the horizon,) which plank was near 14 feet long, 10 inches broad, and about 2½ inches thick; to one end of this plank I fastened a large scale, used for weighing, and secured it well by triple cords at each angle. I then brought down the other end of the plank sufficiently low to raise the scale above the level of the cart, and in this position had it bound firmly by several rounds of cord to the vessel which I desired to raise: I then had the scale loaded with heavy matters, (weights, pieces of iron, and bricks,) till it balanced the vessel, after which it was easily raised and placed in the cart, by backing the horse till it came under it in the proper position; and then, by taking the weights out of the scale again, the apparatus was as readily disengaged.

I found this simple apparatus so convenient for loading carts, that I used it several times afterwards for lifting casks of Epsom salts, and other matters, under 20 cwt.; which leads me to suppose, that one on the same principle would be found very useful for raising any weight greater than what one man could lift with facility, and that it would be advantageous to have one erected permanently for the use of any business where heavy weights are required to be raised from the ground into carts or waggons.

When an apparatus of this kind is wanted for permanent use, I would recommend the following alterations to be made in its construction. Instead of three spars placed as before described, a single post might be fixed erect, about 10 feet high, and be well secured from inclining from the perpendicular position by the usual means; in the top of this post a hole should be bored vertically, 1½ foot deep at least, and be secured by an iron cap well fastened, having an aperture directly over the hole; the use of this hole is to receive the shank of a piece of strong iron, forked above to receive the centre of a balance beam, and having holes in the forked parts for a gudgeon to be passed through them and the beam; a scale should be fastened well by chains to one end of the beam, so as to be about four feet from the ground when the load was fastened to the other end of the beam, or a little higher than the bottom of a common cart, and the other end of the beam should be furnished with a short chain and hook for taking up any packages or other matters which were required to be raised into carts. A number of half-hundred weights should be also provided, equal collectively to the weight of any package usually sent off the premises. The square half-hundreds, which are made with a handle sunk in the body of the weight, would be most handy for this purpose, as they could be readily piled one on another in the scale, when required, without any danger of falling off; weights of other sizes might doubtlessly be used for the same purpose; but it seems to me, half-hundred weights could be raised quicker into the scale than larger or smaller sizes, for a given load, by men of ordinary strength. It will be obvious, that the use of the forked support for the balance beam having a shank descending into the body of the post, is to admit of the beam being turned round horizontally; for the greater convenience of putting goods into casts, while they remained in a fixed position; for which reason the shank should be well rounded above, and fit properly in the cap, and should also have a socket let down into the body of the post to sustain its lower extremity, to admit of its being turned round with more facility.

As this apparatus serves most of the purposes of a crane, if it should ever come so far into use as to require a name, I would propose to call it the *Balance Crane.*

All the cranes hitherto used have a defect, from which this, which I propose here, would be free, which is, they require very near as much time to raise a small weight as a large one; for though the winch, or other operating part, which puts the machinery of the crane into motion, may be turned round somewhat quicker for the small weight; yet as it must be turned round an equal number of times in both cases, the different degree of speed which a labourer *will* use with the smaller weight will not be found of much benefit; whereas with the balance crane, the time and the labour must be exactly proportionate to the load to be lifted; ten hundred weight only requiring half the number of weights to be lifted which would be necessary for a ton, and a smaller load proportionally less.

I have seen some cranes where this defect was attempted to be obviated, by having two or three toothed wheels of different sizes on one axle in the machinery of the crane, so fixed, that the pinion turned by the winch or handle of the crane, might be transferred from the wheel of the larger diameter to that of the smaller size, when required for a smaller load; but it is obvious that this contrivance could have but a very narrow limit, and could only vary according to the number of wheels placed for that purpose; the addition of which proportionally increased the expence of the crane, and its complication, while the principle of the balance crane enables it to vary its power, and the time of the operation, exactly in proportion to the load, without any complication of parts, or additional expence of construction.

I have a plan for another crane on similar principles, which I think considerably superior to those described here, when intended for constant use; and which, when wanted for raising great loads, frequently would cost but little more than the last; but to make this known as it should be, I must wait for some better opportunity.

Description of a gun-carriage for naval use, and jointed ramrod. By Mr. W. Pringle Green, *Lieut. RN.*

From the Transactions of the Society of Arts, &c. Vol. XLII.

The large silver medal of the Society was presented to Lieut. Green for this communication.

WITH AN ENGRAVING.

By the present mode of fighting a cannon on board ship, the apparatus to each consists of two side-tackles, for the purpose of running out the gun after it has been fired and reloaded, a train tackle, a rammer and sponge attached to one handle, a rammer and worm to a second, a rope rammer and sponge, and a crow-bar and handspike. There is also a ladle to every fourth gun, for the purpose of drawing out the shot when the powder does not ignite, owing to the gun being wet, or foul on the inside.

The before-mentioned apparatus lumbers the deck; and by the present mode of working, seven, nine, thirteen, or more men are required to each, according to their calibre; this prohibits the merchant shipping from fighting all their broadside-guns, and from carrying one or more heavy cannon, by which they could in many instances disable the ship chasing them, and thereby escape capture; and when several vessels are in company at sea, or in an exposed harbour, could form a formidable battery, bidding defiance to the attacks of privateers and row-boats.

The sponging and loading a long gun with the present unwieldly staff is both a dangerous and difficult task, and not at the most favourable time to be accomplished without great danger of the men performing that duty being killed or wounded, owing to extending their bodies out of the port-hole to enable them to manage the staff. It is also difficult to load a gun when fighting, on the lee side of a low vessel, or on the lower deck of a line of battle ship; at such times, should the rammer-head be entered in the gun, and the ship roll, the sponge is unavoidably plunged into the sea; and if the staff escape being broken, it is rendered useless until the sponge is washed and wrung, and the gun is then to be sponged with a wet sponge, which is often a dangerous experiment, nor is there any means to put on a clean one; many staffs are broken, when plunged into the sea, from the velocity of a ship through the water, and many are also dragged out of the men's hands and totally lost.

In running out a gun by the side tackles, it seldom occurs when it is out, that it points to the object, owing to its not being possible to equalize the exertions of the men at the two tackles, and from the pitching motion of the ship throwing the gun out of its place; the crow-bar and handspike are then to be resorted to, to train it, which operation necessarily occupies much time, and often, while performing, the opportunity of firing is altogether lost. Much time is also spent in coiling down the side-tackle-falls, which at all times requires great attention, and much caution when the guns are fired, to prevent the men from entangling their legs, by which many, unaccustomed to a battle, are thus wounded, as also by the staffs being thrown about by the falls when they become entangled together.

By my improved mode, two or four men run a gun out of the port-hole, according to its calibre; and in case of emergency, in small vessels, one man can accomplish this. When a gun is running out, the man holding the trigger-line guides it by the handspike, or other lever, at once to the object, and it is by him instantly fired, without the loss of time in veiling down the side tackles, the necessary attention to the breeching, and to training the gun.

The breeching checks the gun in its recoil, so that no strain is either upon the axle or rope by which it is run out; and that no accident may occur to the mechanism, when the gun is fired, it is so constructed as to be thrown out of gear at that time. If it should be shot away or broken, any person having a hammer, a spare axle and wheels, can complete the whole; and this accident cannot occur unless a shot passes through the sill of the port and breast-piece of the carriage: such a shot is as likely to disable the guns upon the present as the improved plan.

The improved staff answers the purpose of the four now in use; the one made for experiment for a nine-pounder long gun was of five-eighths round bar iron; nine feet of which weighed nine pounds: this size, though tapered from the centre to the ends, is sufficient to load a thirty-two pounder; the tapering reduces its weight to seven pounds, but the staff may be hollow from the joint to the screw ends. As regards the weight, it would be immaterial were it twice as heavy as those in present use; because, from its construction, its leverage is so much less. The improved staff is jointed in the centre, and has screw-ends for fixing on the sponge, the worm, ladle, &c. This enables the men at every gun to have the whole of their implements at hand without lumbering the decks, and on no occasion to wait one for another, as is now the case; and if loading a gun upon a lower deck or in a low vessel (particularly on the lee side, when rolling), the sponge-head, from the staff being jointed in the centre, can be turned upwards, to prevent it from either dipping into the sea, being broken, or forced out of a man's hand; and there being no lever upon the man, he continues the operation of loading, which he could not do at such times with the long wooden staff. Again, should the sponge become foul or wet, a clean one can be put on at pleasure; and if a jointed wooden staff, after the proposed plan, be

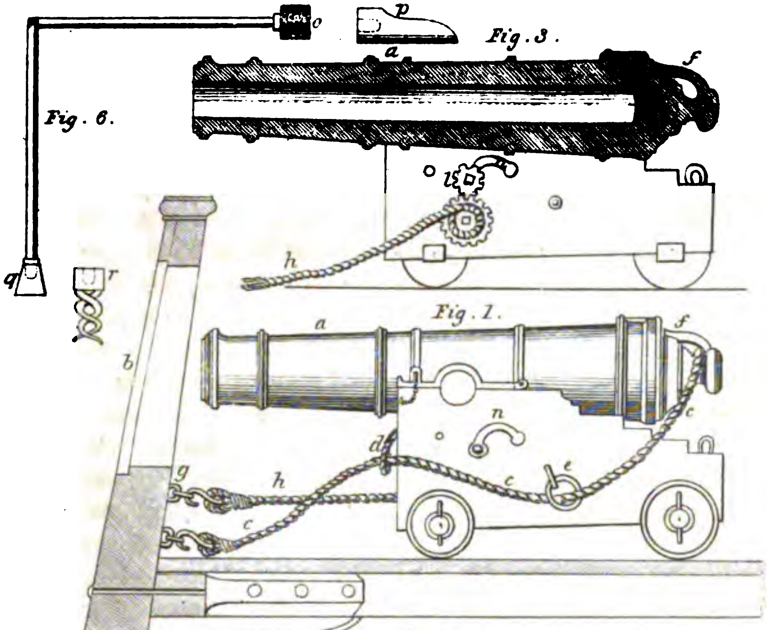


Fig. 6.

Fig. 3.

Fig. 1.

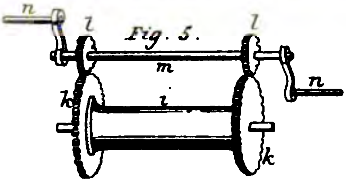


Fig. 5.

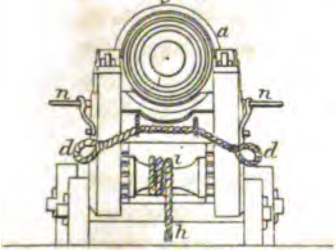


Fig. 2.

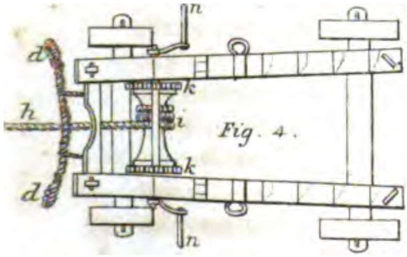


Fig. 4.

Fig. 9.

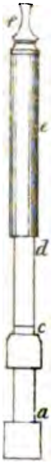


Fig. 8.

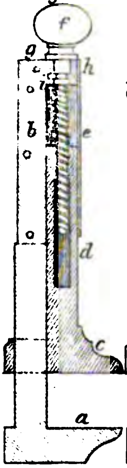
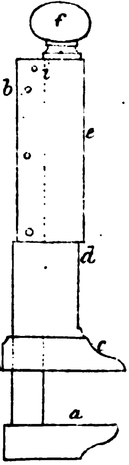


Fig. 7.



adopted, very considerable expense will be saved, as any piece of wood will then answer the purpose. By the present mode of warfare, the cartridge is flannel; and if paper be used, a flannel bottom is put to the cartridge, which prevents the necessity of worming so often as was formerly the case; but if any deem it expedient to worm a gun frequently, a spring wad-hook may be fitted in the sponge-head, so that the gun will be wormed every time it is loaded.

With the improved staff, the man loading has no necessity at any time to expose his body outside the port-hole, as is now the case, as he can, with one hand extended, easily perform this operation, which his whole exertion could not at such a time accomplish with the present staff.

The improved staff is considerably shorter than those at present in use,—can be speedily turned under the port outside,—also on the inside under the deck,—is handed in and out of the port-hole with the same pliability and facility as a rope one,—consequently one half the time is gained by this in loading a gun. With one of the improved staffs to each gun, and a few spare ones to each deck, the many now in use will be rendered unnecessary.

Reference to the figures of Lieut. Green's improved gun-carriage and ramrod. Plate III.

Fig. 1. A lateral elevation of the cannon, mounted on its carriage. Fig. 2. A front elevation of ditto. Fig. 3. A section of ditto. Fig. 4. A bird's-eye view of the carriage, the gun being dismounted. *a.* The gun. *b,* fig. 1. The port-hole.

ccc, fig. 1. The breeching, secured at one end to a strong eye-bolt driven into the ship's side, then passing through one of the loops in the breast rope, *d,* through the ring, *e,* on the side of the carriage, and the loop, *f,* at the breech of the gun, whence it passes on the other side of the gun through the other carriage ring, through the other loop in the breast rope, and is finally secured to a strong eye-bolt like the former, fixed on the other side of the port-hole.

g, fig. 1, is an eye-bolt into which is hooked the rope, *h*, figs. 1, 2, 3, 4, which passes round the axle *i*, figs. 2, 4, 5. This axle is toothed at each extremity, as shown more plainly, fig. 5.

l l, fig. 5. Two pinions fixed on the axle, *m*, take into the teeth of the axle, *i*, and by means of the power of one or two men applied at each of the winches, *n, n*, figs. 1, 5, and 4, wind up the rope, *h*, and thus bring the gun to the mouth of the port. When this has been done, the axle, *m*, is to be thrown out of gear by being raised from the bottom of the curved hole, *m*, figs. 1 and 3, to the upper extremity of the same, and the winches are to be taken off. The gun being then fixed, unwinds in its recoil the rope on the axle, *i*, and is finally stopped by the resistance of the breeching; the winches are then fixed on the axle, *m*, and the axle is again brought into gear in readiness for winding the gun to the mouth of the port as soon as it has again been charged.

Fig. 6. A jointed rammer, made of wood or of bar iron, either hollow or solid. The ends, *o* and *q*, may be unscrewed and replaced by the screw, *r*, or the scoop, *p*.

Description of an improved screw-wrench, invented by Mr. THOMAS EDDY, 354, *Oxford-street.*

From the Transactions of the Society of Arts, &c. Vol. XLII.

The silver Vulcan medal of the Society was voted to Mr. Eddy for this invention.

WITH AN ENGRAVING.

THIS screw wrench is actuated by a screw, as that is which is in common use, but differs from this latter in the screw being introduced into the sliding part instead of into the handle. By this arrangement the instrument is rendered much stronger, and is not liable to open and shut by the turn of the hand while using it, as is the case with the common one.

In manufactories where the work is heavy, the common wrench is often breaking in the screw, an accident which cannot occur with the new one, as the strain is not on that part which contains the screw. It may be made at nearly the same expence as the one in common use.

Reference to the engraving of Mr. Eddy's screw-wrench. Plate III.

Fig, 7 is a side view. Fig. 9 is an edge view. Fig. 8 is a longitudinal section.

(The same letters refer to the same parts in all the figures.)

a is the fixed chap, *b* is the fixed bar, *c* is the moveable chap which passes through and slides upon the bar, *b*; *d* the moveable bar fixed to the chap, *c*. This bar has a hollow barrel screwed at its orifice, in which the solid thumb-screw, *f*, works.

At the extremity of the bar, *b*, is formed a shoulder, on which rests the square piece, *g*; or the bar may be turned up at right angles, forming a short projecting leg, which will answer the purpose of the piece, *g*, and will be both stronger and cheaper. A square hole is to be made in *g*, to admit the screw, *f*, and this hole is to be contracted in one part by the insertion of two square pins, *i* and *h*, which confine the neck of the screw so as to allow it to turn round, but not to move backwards or forwards: *e* is a plate of iron, wrapped round the end of the instrument in order to keep the parts in their proper places, and to prevent the screws from being choked with dirt.

Hence it is obvious, that when the screw, *f*, is turned in one direction, the barrel, *d*, with the chap, *c*, is pushed towards the chap, *a*, and that it is withdrawn when the screw is turned in the opposite direction.

NOTICES OF NEW PATENTS.

The number of patents having greatly increased since the commencement of the Repertory in the year 1794, it has become impossible to publish the specifications within any moderate period; even the most important of them, which was the original intention and aim of the proprietors of the Work: they have therefore determined, on the commencement of the present Volume and New Series, to give an account in an abridged form, accompanied occasionally by remarks, of every new patent, as soon as the specifications shall be enrolled, or as speedily as circumstances will permit, with the view of gratifying the immediate curiosity of the readers of the Repertory, and afterwards to print the specifications of such patents as, from the intrinsic value of the inventions, their extensive use, or other attractions, shall have become objects of public attention and general interest.

In the selection of specifications for subsequent publication, the Editors will always be happy to attend to the suggestions and wishes of the constant readers of the Work; and they take this opportunity particularly to invite patentees to favor them with the loan of their specifications, or accurate copies of them, at their earliest convenience.

Patent granted to JOHN VALLANCE, *of Brighton, Esq. for producing locomotion by stationary engines.* Dated Feb. 19, 1824.

Abstracted from a pamphlet published by the Patentee.

To produce locomotion, or the transport of persons and merchandize from one place to another, by stationary engines, Mr. Vallance proposes to form an arched tunnel, or hollow cylindrical passage, between the places, at the two ends of which are to be placed exhausting engines, worked by steam, or other power, to draw the air from that end of the passage to which it is required to effect the conveyance, and thereby cause a strong draft of air through it from the opposite extremity. The carriages for this purpose are to run on a rail-road within the tunnel, and to have in their front a vertical plane nearly fitting the passage, and capable of being turned either at right angles to its direction, or in the same line with it, as required, or some similar contrivance, for regulating the impulse of the air.

Suppose two places, A and B, ten miles asunder, have a tunnel of this sort placed between them, the loaded carriage being put in on the rail-road at A, and the exhausting engine at the other end of the tunnel at B, being set to work, on a signal being made for that purpose; and the vertical plane of the carriage being placed across the passage, the act of exhaustion of the air will, soon after it commences, cause the pressure of the atmosphere to act on the opposite side of the plane in proportion to its progress, and will thus impel the carriage towards the other end where the engine works with a velocity proportionate to the excess of the pressure over the resistance. In this plan it is evident that the pressure of the air between the vertical plane and A, will be, in all parts, very nearly the same as that of the atmosphere, and that the pressure between it and B need not be diminished, in order to produce a very considerable impulse, more than the difference indicated, between settled fair and much rain, by the barometer, as observed by the patentee, in the pamphlet which he has published, to say nothing of that which exists between the atmospheric pressure at the level with the sea and that on lofty habitable mountains, or that which has been borne without inconvenience under diving bells; and, indeed, had it not been for the carelessness of the editors of some periodical works, who gave the plan of Mr. Vallance the very erroneous appellation of "travelling in vacuo," (though we believe without the smallest ill will to it,) the mistakes which have taken place on this point would probably never have occurred, and Mr. Vallance, and his readers, been spared the laborious confutation of this chimera in his pamphlet.

The patentee has been also at great pains, in his pamphlet, to prove that his tunnel may be made sufficiently air-tight for the purpose; a point which no one could doubt who has known of the works of a similar nature, which are made water-tight, which is more troublesome to effect; indeed, so little difficulty does there appear in making the tunnel impervious to air, that we think the author's project of making bricks of a peculiar shape and fabric for its construction, or what he denominates "burnt clay (not bricks) shaped for the purpose," will be found unnecessary; and that common bricks and mortar will be found very sufficient for it, and that by covering it with earth, which it will be advisable to do for other reasons that shall be mentioned, it can be still farther secured, in this respect, at a cheap rate; and that, moreover, by pudling this earth, in the manner done to make canals water-tight, an additional resource remains for means to exclude the air, if desired. The chief nicety in fabricating the tunnel would probably consist in making it very even inside, and exactly shaped to the same section throughout; and it would be necessary to plaster or stucco it smoothly for this purpose, so that the transverse plane attached to the carriage moving in it, might be made to fit it more closely, and have as little space as possible left between its edges and the inside of the tunnel.

The patentee, in stating the power of atmospheric pressure in conveying goods and passengers in this method, very needlessly incumbers himself with the merits of Mr. Palmer's rail-road, in the praises of which he is profuse, and with those of Mr. Brown's vacuum engine. (See Repertory of Arts, vol. XLV). So far from agreeing with him as to the first, we really are at a loss to conceive any point in which Mr. Palmer's plan excels the common projecting rail-road, it being subject to the same friction of hollow-edged wheels moving on bars or rails; (the grand defect of all plans for rail-roads, hitherto brought forward, being in the friction of the sides of the wheels against the rails, and being, in rail-roads of the description mentioned, only somewhat less than in tram-roads;) and besides, we think Mr. Palmer's rail-road would be very expensive;

from the cost of the pillars to support the rail which it would require, and difficult to keep in order; from the liability of these pillars to be forced sideways out of a vertical position, as well as to sink at their foundations, from the pressure: but if Mr. Vallance can make good his opinion on this point, by real proof; we shall be very willing to allow him the full advantage of it in increasing the power of his project; but till then he must be content with being granted the 100 pound load, which he first claims for every pound of impulse on his transverse plane, as we cannot spare him the other 200, that he desires, on bare assertion. However, the 100 pounds will do very well for him, and ought to content any moderate speculator; since, on the tunnel-road that he proposes, of 11 feet and a fraction diameter, or 100 square feet in area, the moderate pressure, easily procured, of two pounds on an inch, would produce a force equal to 12 tons 17 cwt. on his transverse plane; which, multiplied by the 100 lbs. which we allow, will give him a load of 1210⅓ tons, to be transported by this impulse; a weight so great as almost to stagger our faith! and which we must qualify by claiming for it the due proportion of wheels, at least one to every 1300 pounds of the load, and those truely set and turned, on well-formed axles properly oiled, and moving on a rail-road without any ascent. As to Mr. Brown's engine, as the patentee somewhat recants in the appendix, we shall decline, at present, farther discussion on that subject.

The next matter in importance to the great loads to be carried at once in the patentee's tunnel, is the velocity with which he thinks they can be moved through it. And here again we are sorry we must prune somewhat from his expectations; even granting that he could, as he asserts in his advertisement at the end of the pamphlet, transport a carriage at the rate of 60 miles an hour in a tunnel *one mile long*, it does not follow that he could do so in one 60 miles long, or even a sixth of the distance, and for a cause that he is well aware of, as he has pointed out means of obviating its effects in one instance, which is the resistance to the passage of the air from the friction against the inside of the tunnel, and from the eddies which this will cause in its internal motion.

To convey air through long tubes has only been required in mines; and being mostly a point of curiosity hitherto, we do not know that the rate of the resistance to its motion in them has been yet determined in any precise manner. All we have yet seen on the subject is the account of the experiment of the late Mr. Wilkinson, the well-known ironmaster, (printed in the 8th vol. of the "Retrospect of Discoveries, &c." p. 60,) which the patentee notices; a paper on blowing machines, in the *Journal des Mines*, No. 152; and another, the title of which we cannot now recollect. But these documents are relative to *forcing air* through pipes, which is very different from drawing it out from them, as the author observes; but still we may extract some inference from them; for if Mr. Wilkinson found it impossible to force air through pipes 5000 feet long, and one foot in diameter, by the power of his water-wheel, or indeed farther than 600 feet in any sensible degree, we must conclude, fairly, that atmospheric pressure, by which the extracted air is to be replaced, and which is to give the operating impulse to the author's carriages, will also have its limits, and the moving forward much quicker than the compressed air. Yet we cannot suppose that it possesses any magic power, to enable it to pass instantaneously through obstacles which resist compressed air altogether. The same resistance from friction against the inside of the tunnel, that the air experiences in entering, will also operate to retard its passage outwards to the exhausting engine; and it will be delayed, probably, most of all, in the first instance, by the limited powers of the exhausting apparatus; which, granting all the expedients for the purpose to exist which the patentee hints at, must still be on an enormously expensive scale, to exhaust air, at the rate of 60 miles an hour, from a tunnel 10 feet square in area, as he proposes, which would not be less, in one minute, than 52,800 cubic feet, or 319,994 gallons. Here then we must make some reductions: to bring down the velocity to a tenth of this, or six miles an hour, with a tunnel of this size, will still, we fear, leave the apparatus too expensive. Let us then suppose the tunnel reduced to an area of 30 square feet, or six feet and a fraction in diameter, (which is the smallest size that would allow of a carriage with passengers to pass through it with any convenience,) the exhaustion necessary for a velocity of six miles an hour, would then be 9,696 gallons in a minute. This would come within compass, perhaps, especially as we are aware there are means for drawing off the air from the tunnel, without metallic air-pumps or cylinders, which are objectionable both from their friction and cost, or without the application of Mr. Brown's vacuum engine, as proposed by Mr. Vallance.

We have now been obliged to lower the patentee's calculations a good deal of the powers of his invention; but even on the last scale mentioned, its effects would be very great, being able to transmit 363 tons, by the pressure of two pounds on a square inch, in an area of 30 feet, or that of a tunnel about six feet in diameter.

There is one point more in which the tunnel road would be inferior to a common rail road, and of which, though very obvious, the patentee takes no notice; which is, that in the tunnel road but one set of carriages could pass through it at the same time. If, for example, the tunnel were 60 miles long, the goods and passengers entered at one end at the same time, must fairly pass through the whole 60 miles before a second load could be put in motion in it to any useful purpose; while, on a common rail-road, as many carriages may be moved at once as can be placed on it; nor does there seem any way of diminishing this difficulty, but by making short stages in the tunnel, with an exhausting engine for each; but even with this disadvantage, it would form a most powerful apparatus for the conveyance of merchandize; since, in stations suppose of 12 miles asunder, with exhausting engines capable of causing the load to move six miles in an hour, in a tunnel of the dimensions last mentioned, twelve times 360 tons might be transmitted 144 miles in 24 hours: a quantity so great, and so much beyond the wants of any traffic existing between any two places in England, that it may be diminished very much by putting the stations farther asunder, and using less powerful engines, which would proportionably lessen the expense, and enough force be still left for any purpose that can be required. And even with these reductions the power of the apparatus, as thus fairly calculated, will seem chimerical to some; what then will they think of the assertion, that its power may be easily doubled, by having engines capable of exhausting the air quick enough to cause a pressure of four pounds on each square inch of a plane placed across the tunnel, which is certainly as possible as to produce the pressure before stated.

Having mentioned the points wherein we differ from Mr. Vallance, we think it fair to state some of the advantages of his plan not yet noticed. The first is, that the most severe fall of snow, which would render all common railroads useless for the time, could have no injurious effect on the traffic by his tunnel, or stop it for an hour; and the next, which has escaped the patentee himself, is, that in a great proportion of the length of the tunnel, the ground through which it passed could be made as useful for agricultural purposes as before, as the tunnel could be sunk beneath the surface, or covered with earth sufficiently for grass crops in most cases, which would, at least, form a drawback against the cost of the land, in proportion to the rent the ground above the tunnel would produce.

The patentee, in the first part of his pamphlet, has clearly shown the fallacy of the expectations which have been raised, of the prodigious velocity with which carriages could be moved on common rail-roads; the great danger of their running off the rails, and being upset, when moved very rapidly, and the extreme risk of life, which must arise from the high-pressure steam engines necessary for them. He has also proved the great inferiority of locomotive steam engines to those which are stationary, in the work which they can perform for a given quantity of fuel, as well as in other respects; showing, that the consumption of coals is in general five times greater in the locomotive engines for the same horse powers, and in some cases much more, when compared with a few particular stationary engines of superior performance; which, added to the locomotive engines having to move their own weight, which seldom is so little as five tons, in addition to that of the articles to be transported, gives stationary engines a decided superiority where they can be used for the propelling carriages, which they certainly may in the author's air tunnels. We must however wait for another opportunity to resume this part of the subject, which, with some other matters relative to it, we hope to notice in a future number, having already exceeded the limits proper for this paper, and within which we hoped to have stated the whole of what we had to observe relative to an invention which we think extremely ingenious, and, in fact, the best for the purpose yet made public; which purpose we consider of extreme importance to the mercantile interest of England.

In lowering the calculations of the powers of the author's contrivance to something of a human standard, we trust we may have benefitted both him and the public; since a good thing may be neglected by being introduced with pretensions so prodigious, as to exceed the belief of all moderate men; and we will now conclude with our best wishes for the patentee's success in his very useful undertaking; assuring him, that should it be found, on trial, to exceed the powers of our estimation, we will not the less rejoice at the benefit this must be to our country, and be glad to give the fact every publicity in our power.

Patent granted to Mr. William Shalders, *of Norwich, for a gravitating expressing fountain, for raising and conveying water or any other fluid.* Dated April 12, 1825.

Mr. Shalders' engine is a species of forcing pump, formed by a buoyant plunger, working up and down in a vessel of suitable capacity, through the intervals between which plunger and vessel the liquor is prevented from passing by a leather cylinder (or bottomless bag), the lower part of which is fastened securely to the vessel, and the upper part to the plunger, so that the joinings may be water-tight. There is, besides, another hollow cylinder, of wood or metal, whose lower part is fastened water-tight to the top of the containing vessel, and whose top rises high enough above it to hold within it the leather bag, at its greatest elevation, and whose capacity is sufficient to admit of the passage of the leather bag up and down between it and the plunger without friction. Into this apparatus a tube enters at its lowest extremity, to admit the water or liquor, furnished with a valve to prevent its passing back again; and from the same part another tube passes upwards, having a similar valve to prevent the liquor from returning down into the vessel, and whose purpose is, of course, to convey the liquor to the height and distance required.

Two of these vessels are represented in the drawing and specification, connected together, to be worked alternately in a reversed direction, and with the two eduction pipes joined into one, for the purpose of producing a constant uninterrupted stream of the liquor.

When the source of water is by any means as high as the vessel that contains the plunger, this latter, being made lighter than water, will of course be buoyed up in proportion as this difference of gravity takes place, which the patentee thinks an advantage: and will also be forced up by the hydrostatic pressure in proportion as the source is higher than the top of this vessel.

The patentee does not restrict the materials of the vessels or plunger to any peculiar matter or combination; and the drawing shows a frame-work, above the apparatus, through which the plunger rod passes, so as to work up and down steadily, without pressing the connecting leather against the sides of the vessels.

The drawings represent the vessels and plunger as being made of coopers' ware, which, though it may be cheap, is certainly too liable to derangement to be as advisable as other materials within the limits of the specification. We also think the leather bag (or connector) would work easier and last longer, if furnished with some internal hoops, with bands between them outside, in the manner of the cylindrical bellows, or the still older instrument—the French hair-powder puff.

Patent granted to Mr. CHARLES ANTHONY DEANE, *of Deptford, for an apparatus to be worn by persons entering rooms filled with smoke or other vapour, for the purpose of extinguishing fire, or extricating persons or property.* Dated Nov. 20, 1823.

Mr. Deane's apparatus is composed of a copper helmet or head covering, with a garment attached to it of some substance not easily set on fire. The back of the helmet is made double, and to the lower part of it a long tube of leather is fastened, by which fresh air from without may be conveyed to the wearer by a double bellows, placed for that purpose in a box outside the building. The air that enters the hollow part at the back of the helmet is distributed by several passages, two of which open near the apertures for the eyes, in order to keep the breath from condensing on the glass with which they are covered, and obscuring them; the glass is also protected by a small grating outside. Opposite the mouth a circular revolving valve is placed, similar to those used for air regulators in some of Rumford's stoves, which may be opened or closed according as the button in front is turned. When it is closed, all communication with the room and the mouth of the wearer is closed, and he then alone inhales the air supplied by the pipe, while his breath passes off as respired along with the current of air from the bellows, by another pipe, that descends from the helmet to his foot, to which it is secured by a strap, to keep it in a proper position.

To prevent the air-pipe being closed by a beam or bricks falling on it, or any other accident, a rope is passed through its whole length to keep it open.

The person entering a room full of smoke, after fastening on the helmet and dress described, by straps, so placed as to prevent the entrance of any vapours from without, and tying a lighted lanthorn to his breast to direct his steps, and taking with him proper implements for breaking open doors or other obstructions, closes the valve opposite his mouth as soon as he finds any inconvenience from the smoke, first giving notice to his assistant without to work the bellows; after which, he breathes solely the air supplied by the pipe.

The box in which the bellows is placed is so contrived, that the helmet, dress, pipes, and whole apparatus may be easily packed up in it together, to facilitate their transportation.

By this apparatus, the patentee asserts, that a person may breathe with facility in a place so full of smoke or other vapour as to suffocate him without its assistance, and be enabled, in this dangerous situation, to remain sufficiently long to remove property of value, and in many cases to save the lives of persons in houses on fire, who would otherwise fall a prey to this awful element.

The Society for the encouragement of Arts, &c. on the 30th of May last gave a premium of fifty guineas, and the large silver medal, to Mr. J. Roberts, of St. Helen's, Lancashire, for an apparatus for enabling persons to breathe in air loaded with smoke and other suffocating vapours, which, as far as we can learn of it, is extremely similar to that of the patentee, Mr. Deane, the patent for which was sealed eighteen months previous to the meeting of the Society in which they gave the above premium for the apparatus of Mr. Roberts.

Patent granted to Mr. EDWARD SCHMIDT SWAINE, *of Bucklersbury, London, for a communication made to him by Frederick Adolphus Augustus Streeve, of Dresden, M.D. and Edward Swaine, of Leipsig, merchant, for a method of producing and preserving artificial mineral waters, and for machinery to effect the same.* Dated 9th October, 1823.

The principal instance given in this specification of the general purpose of this patent, is the mode of making artificial Seltzer water, by impregnating common water with carbonic acid gas.

The apparatus for this process consists of a vessel of lead, into which the patentee introduces the materials from which the gas is to be produced by the action of sulphuric acid (among which materials, by some strange error, he mentions lime-water and lime). At the top of this lead vessel is fixed a funnel, communicating with it by a pipe, closed by a lead stopper, for holding the sulphuric acid, which passes into the lower vessel on raising the stopper. A bent pipe proceeds from the top of the lead vessel downwards, to the lower part of another closed vessel, containing a solution of barytes (to purify the gas from sulphureous acid gas) from whence another pipe conveys it to a gas holder, formed in the common method. From the holder the gas passes to a gasometer, made on Mr. Clegg's principles, whence, after passing through its revolving chambers, and having its quantity registered by the counting apparatus, it is drawn through a pipe into an air-pump, fixed in a horizontal position, and worked by a revolving crank and fly-wheel. Above the pump are placed two small chambers, which communicate with its different ends; into one of these the gas is forced by the pump, on its way to the impregnating vessel, and the other holds water only, for acting against the back of the piston to diminish the friction. To the pipe, which goes from this part of the apparatus, is joined a barometer, whose index shows the pressure acting on the gas. Over the impregnating vessel, into which the gas next enters, and which is filled with pure water, there are two small chambers fixed, from which pipes pass to it, and whose office is to hold any fluid compound intended to give flavour to the impregnated water. From the impregnating vessel a pipe passes downwards for filling the bottles, whose extremity is made conical, and covered with a collar of leather, against which the mouth of the bottle to be filled is pressed upwards by a treadle, moved by the foot of the person who fills it. When each bottle is filled, it is instantly corked, and the cork secured by a piece of wire bound over it.

Besides what we have described, the apparatus is furnished with valves and cocks in the usual places, and has also two agitators, one placed in the lead vessel that holds the materials, formed like those used in revolving churns, and turned round by an axle that passes through an air-tight collar at the top of the vessel; and another in the impregnating vessel, formed in a similar manner.

The only thing that appears to us like novelty in this apparatus, is the introduction of the gas-meter, and perhaps the flavouring vessels at the top of the impregnating vessel. We should indeed add to this list the extracting carbonic acid gas from "lime and lime-water," as directed by the patentee, which, from their very nature, cannot contain any of it!!!

Patent granted to Jean Henry Petitpierre, *of Charlton-street, Somers'-town, engineer, for a machine for making, from one piece of leather, without any seam, shoes, slippers, gloves, caps, hats, cartridge boxes, scabbards, and sheaths for swords, bayonets, and knives.* Dated March 20, 1824.

In order to make a slipper in this method, a piece of thick side leather is cut out in a particular shape (somewhat similar to that which a slipper would assume if the upper leather were pressed down flat upon the sole); a groove is made across this about the length of the intended upper leather from the toe; and of the depth of half the thickness; the piece is then fastened down by screw clamps, on a table prepared for the purpose, having the heel part first bent down at the groove, so as to be out of the way. It is now ready for being split or divided by a knife or tool, which is fixed into a frame, having such guides and stops fastened to it (particularly a projecting pin that moves in a slit in the table), that it can only be moved back and forwards to a certain extent, with a very limited lateral motion, and at a precise level above the table, so as in no case to cut lower or higher into the fixed piece of leather than intended.

The hollow of the toe part being formed in this manner, the position of the leather on the table is reversed, and the hollow of the heel part cut by a similar operation. This is the simplest way in which a slipper can be formed by this method, and therefore the best for giving an idea of the mode of proceeding. But as by it the sole would not be left thicker than the sides of the upper leather, in order to obviate this defect, and leave the sole in a proper degree thicker than the upper, the piece of leather must be first cut out in the form before described, which a slipper would assume if pressed down flat at the top. Then this piece must be cut externally at the edges first, by the instrument, at half its thickness from the bottom, and as far in as to the outline of the sole, which is ascertained by having a piece, of the shape of the sole, fastened down upon it by the clamps that secure it to the table. After this it is to be turned down at the groove (cut across as before mentioned), and have the inside of the toe part, and of the heel part, cut open inside by the instrument, at a third of the thickness of the whole piece from the top, in the same manner as first described, by which means the sole will be left of double the thickness of the upper, but projecting at each side beyond its proper shape. The piece being now pulled open, and forced upon a last, after first wetting it, is to have the superfluous parts of the sole pared off, and to be rubbed down by a smooth tool till it assume the form of the foot. It may be then curried and dressed, coloured, and finished as desired.

Gloves, caps, hats, cartridge boxes, scabbards, sheaths of all kinds, and many other articles, may be formed, in this manner, from thick leather, without any seams, by having moulds of fit shape, and knives so constructed, and furnished with such guides and guards, as are most suitable to the article designed.

Besides the saving of workmanship in this method, there would arise a further economy in the quality of the leather, since, according to the prices current, sole leather, by the pound, is in general not more than half the price of upper leather, or calf skins.

That it would succeed well for slippers, and most of the other articles mentioned, seems very probable; but we have great doubts that shoes could be made in this way sufficiently even in the grain of the uppers in all parts, to produce the neatness required for their appearance, as the parts of them cut from the centre of the thick leather must necessarily be more open and spongy than its external surface: and the top of the shoe would thus have quite a different look from the sides, and could never be made to take the same degree of polish in being cleaned.

Another objection to shoes of this kind is, that they could not be mended but in very few cases, without totally disfiguring their appearance, which in shoes, whose chief advantage must be economy, would form a very material drawback.

Patent granted to Mr. JOHN LEIGH BRADBURY, *of Manchester, for a new mode of twisting, spinning, or throwing silk, cotton, wool, linen, or other threads, or fibrous substances.* Dated 3d July, 1824.

Mr. BRADBURY's specification embraces two objects principally: the first being an improvement in the method of performing the operations stated in the title, for which he obtained a patent in 1816; and the second being the application of the machine used commonly in the cotton manufacture, called the mule, to the twisting and throwing of silk.

The first invention, or improvement, consists in causing any pair of delivering rollers in a spinning machine, to cease from turning as soon as the thread breaks that proceeds from them; which is effected by causing the thread, on its way to the bobbin, to pass through an eye in the top of the longer arm of a lever turning on a pivot, which remains horizontal as long as the thread presses on it, in its passage; but as soon as the thread breaks, it rises upright instantly by the action of the short arm of the lever, which is weighted accordingly for this purpose. This short arm, in coming thus to a vertical position, comes in contact with pieces that project from an axis constantly turning round beneath it, and that is placed there horizontally, and at right angles to the plane in which the lever moves. On thus coming in contact with the power of this axis, the short arm is pressed forward, and the long arm of the lever thereby being forced back proportionably, causes an inclined plane attached to it to push back the standard on which one of the rollers is supported, so that the wheel that connects it with the general machinery shall be out of gear, as it is called, and its action on the thread entirely cease, until the lever is again brought to its horizontal position, and kept so by the thread, after its being mended, and laid on it again.

The application of the mule to silk spinning, which is the second object of the patent, consists merely in substituting bobbins of silk for cops of cotton, in the number proportioned for each spindle, according to the thickness of the twist required; and then proceeding with the machine, as in spinning cotton, to give the proper degree of twist, and roll the silk up on the spindles.

In the drawings of this machine, the spindles seem to be inclined forward more than usual, being, in this instance, in an angle of 45° with the horizon.

LIST OF NEW PATENTS.

William Henry James, of Coburg Place, Winson Green, near Birmingham, engineer, for certain improvements in apparatus for diving under water, and which apparatus, or parts of which apparatus, are also applicable to other purposes.—Dated May 31, 1825.—Six months to enrol specification.

John Harvey Sadler, of Hoxton, Middlesex, machinist, for an improved power loom for the weaving of silk, cotton, linen, wool, flax, and hemp, and mixtures thereof.—Dated May 31, 1825.—Six months to enrol specification.

Joseph Frederick Ledsam, merchant, and **Benjamin Cook**, brass-founder, both of Birmingham, for improvements in the production and purification of coal gas. Dated May 31, 1825.—Six months to enrol specification.

Joseph Crowder, of New Radford, Nottingham, lace net manufacturer, for improvements on the Puslew bobbin net machine.—Dated May 31, 1825.—Six months to enrol specification.

Joseph Apsdin, of Leeds, bricklayer, for a method of making lime.—Dated June 7, 1825.—Two months to enrol specification.

Charles Powell, of Rockfield, Monmouthshire, gentleman, for an improved blowing machine.—Dated June 6, 1825.—Six months to enrol specification.

Alfred Bernon, of Leicester-square, London, merchant, for improvements in fulling mills, or machinery for fulling and washing woollen cloths, or such other fabrics as may require the process of fulling.—Communicated to him by a foreigner.—Dated June 7, 1825.—Six months to enrol specification.

Moses Poole, of Lincoln's Inn, London, gentleman, for the preparation of certain substances for making candles, including a wick peculiarly constructed for that purpose. Communicated to him by a foreigner.—Dated June 9, 1825.—Six months to enrol specification.

JOHN BURRIDGE, of Nelson-square, Blackfriars-road, Surrey, merchant, for improvements in bricks, houses, or other materials, for the better ventilation of houses and other buildings.—Dated June 9, 1825.—Six months to enrol specification.

JOHN LINDSAY, of the island of Herme, near Guernsey, Esq. for improvements in the construction of horse and carriage ways of streets, turnpike and other roads, and an improvement or addition to wheels to be used thereon. Dated June 14, 1815.—Six months to enrol specification.

WILLIAM HENRY JAMES, of Coburg Place, Winson Green, near Birmingham, engineer, for improvements in the construction of boilers for steam-engines.—Dated June 14, 1825.—Six months to enrol specification.

JONATHAN DOWNTON, of Blackwall, London, shipwright, for improvements in water closets.—Dated June 18, 1825.—Six months to enrol specification.

WILLIAM MASON, of Castle-street East, Oxford-street, London, axletree manufacturer, for improvements on axletrees.—Dated June 18, 1825.—Six months to enrol specification.

CHARLES PHILLIPS, of Upnor, in the parish of Findsbury, Kent, Esq. for improvements in the construction of a ship's compass.—Dated June 18, 1825.—Six months to enrol specification.

GEORGE ATKINS, of Drury-lane, Gent. and HENRY MARRIOTT, of Fleet-street, London, ironmonger, for improvements on, and additions to, stoves or grates.—Dated June 18, 1825.—Six months to enrol specification

EDWARD JORDAN, of Norwich, engineer, for a new mode of obtaining power applicable to machinery of different descriptions.—Dated June 18, 1825.—Six months to enrol specification.

John Thompson, of Vincent-square, Westminster, and the London Steel Works, Thames Bank, Chelsea, and John Barr, of Halesowen, near Birmingham, engineer, for improvements in producing steam applicable to steam engines, or other purposes.—Dated June 21, 1825.—Six months to enrol specification.

Thomas Northington the younger, and John Mulliner, both of Manchester, small-ware manufacturers, for improvements in the loom, or machine, used for the purpose of weaving or manufacturing of tape, and such other articles to which the said loom, or machine, may be applicable.—Dated June 21, 1825.—Six months to enrol specification.

Ross Corbett, of Glasgow, merchant, for a new step, or steps, to ascend and descend from coaches, and other carriages.—Dated June 21, 1825.—Six months to enrol specification.

Philip Brookes, of Shelton, in the Potteries, Staffordshire, engraver, for improvements in the preparation of a certain composition, and the application thereof, to the making of dies, moulds, or matrices, smooth surfaced, and various other useful articles.—Dated June 21, 1825.—Six months to enrol specification.

John Frederick Smith, of Dunston Hall, Chesterfield, Esq. for improvements in machinery for drawing, roving, spinning, and doubling cotton, wool, and other fibrous substances.—Dated June 21, 1825.—Six months to enrol specification.

THE
REPERTORY
OF
PATENT INVENTIONS, &c.

No. II. AUGUST, 1825.

Specification of the Patent granted to MR. JAMES SURREY, *of Battersea, in the county of Surrey, Miller, for a new method of applying heat for the producing steam, and for various other purposes, whereby the expense of fuel will be lessened.* Dated September 4, 1823.

TO all to whom these presents shall come, &c. &c. *Now know ye*, that in compliance with the said proviso, the said James Surrey doth hereby declare, that the nature of his said invention, and the manner in which the same is to be performed, is described and ascertained in the following explanation thereof, that is to say:

The invention of the said James Surrey consists in bringing into use the heat extracted from coal in the burning and manufacture of coke, by applying the same for the production of steam, for steam engines and other purposes, in manner following, that is to say:—As many coke ovens as may be necessary by the heat thereof to insure the quantity of steam required, being erected in the usual or any other convenient way, let an artificial search be made in each as high as the coals, when charged; and run on the top of the artificial search, a rim or curb of iron, or other substance, of sufficient thickness to retain the heat extracted from the coal or coke. Then place in each of the said ovens one or more tubes or pipes of iron, or other metal, either separate or connected together, on the top of the artificial search; one end of each of the said pipes or tubes to come out at the front of the oven, with a flange for cleansing, and the other end thereof to run out at the back or other convenient part of the oven, a sufficient space being left between the said two pipes or tubes, or elsewhere, as convenient, for the smoke, fire, or heat to escape, instead of coming out at the oven's mouth or stock; and if the ovens be sufficiently large to admit thereof without interfering with the burning of the coke, other pipes or tubes may be introduced in like manner, between the coke and the crown of the oven. And the several pipes or tubes above-mentioned must be made to communicate with the main reservoir or boiler of the engine, or other works. The main reservoir or boiler being charged in the usual way, and so as to keep the before-mentioned pipes or tubes always full of water, steam will be generated and pass to the main reservoir or boiler, for any purpose required. Care should be taken so to place the pipes or tubes in the ovens that the draft be not checked, and that they may be taken out at the front or back of the oven, if required; and the said pipes or tubes should be independent of the ovens, and be so placed that the spring of the ovens will be behind the same. The fire, in passing out of the ovens, may be directed through a flue, and which flue may be conveniently and most beneficially made by carrying over the crown of the oven a second crown or arch, of iron, brick, or other substance, capable of confining and retaining the heat; and such flue may be filled with other pipes or tubes, to be so placed as to receive the greatest possible action of the fire passing through the flue; and the last-mentioned pipes and tubes being also made to communicate with the general reservoir or boiler, and being kept filled with water as before-mentioned, an additional quantity of steam will be generated by means of the same fire or heat, and without any additional consumption of fuel. If the flame of one oven should be found insufficient to consume the smoke of the other, a damper or register may be used to stop the smoke from passing direct through the flue, and a communication made from one oven to the other, by means of a pipe or aperture; also with a damper or register, to take the smoke of either oven alternately through the other, when sufficiently hot to consume the same, thereby insuring a convenient method of consuming the whole of the smoke, and converting the same into heat or flame, to be used or applied as before-mentioned.

In witness whereof, &c.

OBSERVATIONS BY THE PATENTEE.

The principle of this invention consists in the introduction of tubes into coke ovens, &c. for the purpose of generating steam, by which more than two-thirds of the present expence of fuel will be saved, as has been demonstrated at the Patentee's premises, York House, Battersea, where the process has been in actual operation in grinding corn for nearly the last twelve months, producing the most satisfactory results.

The peculiar advantage of this method is, that the coal, instead of being nearly all consumed, is converted into coke, of a quality equal to any that is used by maltsters, and other persons requiring the most pure and perfect article of that description.

The Patentee submits the accompanying statements of the saving that would accrue by the adoption of his patent, to any person at present consuming 1000 chaldron of coals per annum, in London. He is enabled to detail with precision as to the first calculation, which shows the amount or difference by the conversion into coke, and its attendant charges, assuming that 1500 chaldron of coals are used, but preserved and converted by his process, (instead of 1000 consumed and wasted at present,) and that these produce 1800 chaldron of coke, being the relative ascertained proportions.

The second calculation states the sum expended for 1000 chaldron of coals, on the system now in use among Water Companies, which would be saved by the application of his patent, deducting the above-mentioned difference lost on the coke.

The third calculation shows that the expence of the necessary additions to the works connected with the steam engine, would be reimbursed by the profits of the first year's saving; and a considerable surplus also remains above the cost of the works in question; and the annual saving afterwards on every 1000 chaldron of coals now consumed, is shown by the last calculation to amount to 1270*l.* after allowing for wear and tear.

By an arrangement which the Patentee has made with the principal coke merchant in London, who is willing to supply the coal, and receive back the coke, at the relative fixed prices named in the statement, he is enabled to engage with the proprietors of large steam engines in London (where a constant power is required), to perform their work upon the basis and terms specified, or at about half their present expence, without making any alteration in their engines or boilers; or he will grant licences to work under his patents (in England, Scotland, and Ireland), at a sum per annum, or at a premium for the term of his patents. The apparatus can be applied to every steam engine or boiler now in use, either high or low pressure; at the same time acting as a complete smoke consumer.

The Patentee suggests the great advantage and saving that would accrue by the application of the patent in the working of iron mines, as the same expence of fuel which is incurred in raising the water and ore, will smelt the ore; whereas, by the present method, a large quantity of coal is entirely consumed in creating steam for the engine, without giving any return of coke; when by his plan the coals used for steam return their value in coke, which is ready on the spot for the future operations of smelting; and this saves the further quantity of coal which is necessary under the present system for the purpose of producing coke.

The Patentee also suggests that considerable benefit would accrue to the proprietors and the public, by the adoption of Steam Power Coal and Coke Companies, in particular districts in the United Kingdom, by erecting the apparatus, and supplying steam power to individuals; and for which purpose he is willing to grant licences to trustees for the carrying such an object into effect; and for his remuneration will agree to receive a per centage only on the profits of the company, after they are paid the interest for their capital employed; or a certain sum for the exclusive privilege of any particular district.

Dr. STEAM ENGINE. Cr.

Dr.	£.	s.	d.	Cr.	£.	s.	d.
To cost of 1500 chaldron of coals, at 38s. per chaldron, delivered at the water side........	2850	0	0	By proceeds of coke, 1800 chaldron, at 28s. per chaldron..	2520	0	0
To coke burner add 2s. per chaldron ..	150	0	0	By balance, loss in difference of coal and coke	530	0	0
To labour in removing coke	50	0	0				
	£3050	0	0		£3050	0	0
To loss in making coke	530	0	0	By gain in saving of coal, 1000 chaldron being at present used and lost, at 38s.	1900	0	0
To Balance saved ..	1370	0	0				
	£1900	0	0				
To five coke ovens will cost erecting	500	0	0	By brought down, balance saved as above............	1370	0	0
To pipes, will cost..	500	0	0				
To balance, or surplus saved first year ..	370	0	0				
	£1370	0	0		£1370	0	0

Dr.	*All subsequent Years after the First.*			Cr.	
To wear and tear....	100	0	0		
To balance of annual saving on every 1000 chaldron of coals at present consumed	1270	0	0		
	£1370	0	0	By brought down as above..........	£1370 0 0

Specification of the Patent granted to David Gordon, *of Edinburgh, at present residing at Stranraer, Esq. for certain improvements in the construction of wheeled carriages.* Dated August 14, 1821.

WITH A PLATE.

TO all to whom these presents shall come, &c. *Now know ye*, that in compliance with the said proviso, I, the said David Gordon, do hereby declare that the nature of my said invention, and the manner in which the same is to be performed, are particularly described and ascertained in and by the drawings hereunto annexed, and the following description thereof, (that is to say): My invention of certain improvements in the construction of wheeled carriages consists, first, in placing each of the wheels of the carriage between two horizontal bars or rails, in such manner that the wheels may be supported or hung upon bearings or pivots, which pivots may be adapted to turn round in brasses or collars, fixed in the rails, extending on each side of the said wheels. By this arrangement each wheel is furnished with its own axis or axle, having pivots formed at both ends thereof, which turn round in fixed collars (in the same manner as the wheel of the ordinary wheelbarrow), being entirely independent of the other wheels belonging to the carriage. In order to render the application of my invention clear and intelligible, and to enable persons conversant with such matters to put it in practice, I have hereunto annexed a sheet of drawings or plans, wherein fig. 1 (Pl. IV.) shows a plan of the framing, adapted for a cart or two wheeled carriage, upon my improved construction, with the body of the cart or carriage supposed to be removed, in order to explain my invention. Fig. 2 shows an elevation of the same. (Note—the same characters or letters of reference are used to denote corresponding parts upon both the figures.) A A represent the two main bars or rails of the frame of the carriage: they project in front sufficiently to form the shafts, and are kept parallel, and maintained at a proper distance asunder, by two cross pieces, B B, which extend in width beyond the side rails, A A, and serve to support the outermost rails, C C, in such manner as to form two oblong openings or frames, of sufficient width to receive the carriage wheels, D D; each of the wheels, D, is fixed upon a short separate axis or axle, having pivots formed at each end; the outer pivots of the said axes or axles turn in collars, which are attached to the rails, C C; and the inner pivots turn in collars, attached to the rails, A A. The collars may be placed either on the under or the upper sides of the rails, or through the middle thereof, as may be found best; but I should recommend their being fixed on the under sides of the rails, as represented in the figure, with screw bolts passing through the rails, to retain them in their respective situations, and tighten them as they wear away; the bearings may be supplied with oil by pouring it in through a small hole from the upper side of the rails, which holes should be covered by a turning plate or cap, to prevent any dust from penetrating to the pivot: in like manner the pivots should not pass quite through the collars, so as to expose their ends, but should be rendered somewhat convex at their ends, to bear against the bottom of the cavity in the collars, in order to support any shocks endways which the wheels might receive in passing over rough roads: E E represent two iron bars, extending from the rails, C C, to the shafts, in order to strengthen the frame, and prevent the ends of the rails, C C, from entangling with other carriages in passing; otherwise inclined pieces of wood might be substituted for the iron bars, as may be found most convenient: F F shows a framing of wood, placed a little distance above the main frame, as seen in fig. 2, and supported by small blocks, *a a*, rising up from the cross-pieces, B B, in the plane of the wheels, D D, as seen at *a a a a*, in figure 1. The body of the cart or carriage is placed upon the framing, F F, which by its bearing upon the main frame at *a a a a*, in the plane of the wheels, does not tend to twist or strain either the main frame, or the wheels themselves; otherwise, the body of the carriage might be suspended from the under sides of the rails of the frame, at the points, *a a a a*. Fig. 3 on the annexed sheet of drawings represents a plan of the framing for a waggon or carriage having four wheels; the body of the carriage is supposed to be removed. Fig. 4 shows an elevation of the same: A A, the main rails of the frame, which are kept parallel by the four cross rails, B B and G G, being morticed into them: C C are two pieces, lying parallel to the main rails, and morticed into the cross rails, B B. These pieces form the openings to receive the hindermost wheels, D D, of the carriage, the bearings or pivots of which turn in collars fixed to the rails, A A, and pieces, C C, in the same manner as before described in the figs. 1 and 2. The cross rails, G G, have pieces, H H, morticed into them; and these again have a cross rail, I, fixed to them, which carries the traverse bolt or bolster, K, for the front wheels, E E, with their framing, *a a*, *b b*, *c c*, to turn round upon, when the carriage is intended to be turned in its direction. The front wheels, E E, are mounted upon short axes or axles, having a bearing and support in the pieces, *b b*, *c c*, on each side of each wheel (as before described for the hindermost wheels): L M, fig. 4, represent

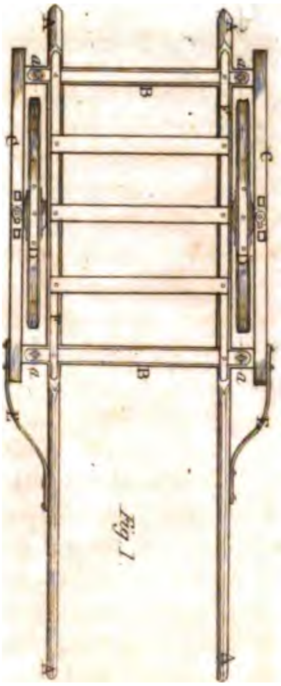


Fig. 1

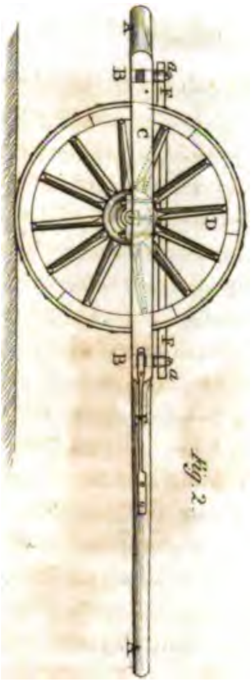


Fig. 2

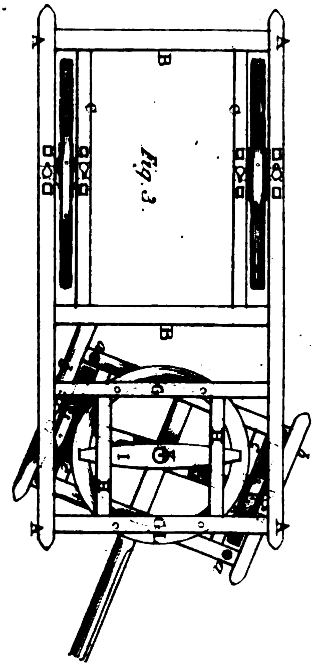


Fig. 3

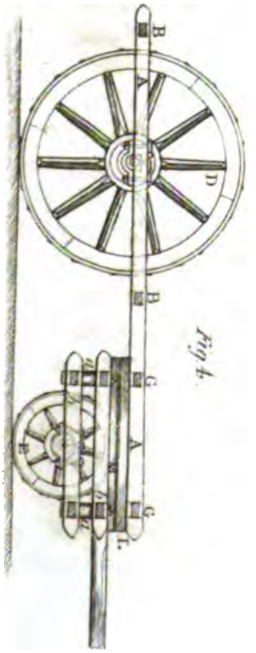


Fig. 4

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two circular frames of wood, placed horizontal, and lying in contact with each other (similar to ordinary four wheeled carriages); they are fixed concentric with the traverse bolt or bolster, x, and serve to steady the front wheels and their framing in turning. The wheels may either have the axes or axles fixed fast in their centres, and be made with pivots or bearings to turn in fixed collars, as hereinbefore described; or they may have boxes fixed in the naves of the wheels, adapted to turn upon fixed bolts or arms, extending across each of the openings where the wheels are to be fixed, always observing that the said bolts or axles do not extend across the framing of the carriage from one wheel to the other. Having shown how and in what manner the first part of my improvements is to be carried into effect, it remains for me to explain what part thereof I consider as my invention; as I wish it to be observed that I do not claim the invention of placing the wheels upon axes or axles, and supporting them on the outsides of the wheels, the same things having before been used. Neither do I make claim to any particular part of the framing of the carriage; but I confine my claim to the placing of each of the wheels upon a separate axis or axle, to be supported between two bearings or rails, and without having any bolt, axes, or axles, extending across the frame of the carriage, thereby leaving the wheels quite independent of each other, so as to allow of the load or body of the carriage being placed or suspended (if required) near to the ground, between the wheels, and even below the level of their axes or axles. At the same time I must state, that I only claim the application of this improvement to carriages having two, three, or more wheels. The advantages of placing the wheels of carriages according to my improvement above-mentioned are numerous. In the first place I am enabled to fix the axes or axles of the wheels horizontal (or parallel to the ground), and thereby obviate the necessity of dishing or hollowing the wheels; and also to render their action upon the roads less injurious, by rolling over the ground instead of grinding upon it, as must be the case with wheels placed in a position inclined to the direction of their motion, such being the usual method of placing the wheels of carriages. Second, the rail which extends along the outside of the wheel (to support the outer pivot of its axis or axle) is an effectual defence to the wheel, and serves to protect it from blows or shocks which it might otherwise receive by other carriages running against it; the said rails also obviate, completely, the inconvenience and risk of carriages becoming locked together, by the wheel of one carriage being forced in between the wheel and body of another carriage, which accident tends to strain the wheels very much. Another important advantage of my improvement is, that the axes or axles of the wheels do not extend across the frame or bed of the carriage from one side to the other, by which circumstance I am enabled to obtain a large clear space between the wheels, for the purpose of containing heavy merchandize, and carrying it near to the ground, for the facility of loading and unloading the same; and furthermore, without the risk of overturning, as must be the case in carriages as heretofore constructed, with the axes or axles of the wheels extending across the carriage, from one side to the other, thereby obliging the load to be carried at a considerable height from the ground; for the same reason I can make use of wheels of a larger diameter than what are usually employed, by which means the carriage would travel over rough and uneven roads with more facility. And lastly, the placing of the wheels upon separate axes or axles, with a bearing on each side, and independent of each other, would be of considerable importance for carriages to be propelled by the power of a steam engine, or other mechanical force, since the wheels could be easily acted upon separately by the moving power, for the purpose of turning the carriage (or changing the direction of its course); at the same time the space between the wheels, not being interrupted by the axes or axles extending across the carriage, would admit of the steam or other engine, and heavy machinery, being placed in the vacant room between the wheels, near to the ground. The second of my improvements in wheeled carriages consists in the application of an additional wheel (to a two, three, or four wheeled carriage), formed like a hollow roller or drum, which drum may be caused to move or roll along the road (in order to advance the carriage forwards), by having a steam or other engine placed withinside of it in such manner, that the engine would tend to advance or climb up the inside of the drum; and so by its gravity to turn the drum round (in the manner of those machines termed walking wheels, which are used in cranes, &c.) and would roll it forwards, advancing the carriage along with it. To effect this, the drum may be furnished with one, two, or more endless racks, extending round its inside circumference, into which rack or racks a toothed wheel or wheels may be made, to engage such wheel or wheels being put in motion by the power of the engine. By this arrangement, the toothed wheels being connected with the engine would, by their motion, always tend to advance up the inside of the drum along with the engine, and turn the drum round to roll it along the road. The toothed wheels may be kept in their places upon the racks by having high ledges or projecting rims formed on one side of each of the said wheels; such ledges or rims to bear against the sides of the racks. I should recommend the above described drum to be situated in the frame of a carriage, in place of the large or hindermost wheels, and be connected with the frame of the carriage by means of iron rods or arms, one end of which rods or arms should be jointed to the axis of the toothed wheels before mentioned, within the drum; and the other ends of the rods or arms should be jointed, or otherwise fixed, to any convenient part of the frame of the carriage, so that the drum, on rolling along, would necessarily move the frame of the carriage with it. The course of a carriage of this description could be directed by turning the fore wheels round (with their frame) upon the traverse bolt or bolster, by means of a rack and wheelwork, or other similar contrivance, whilst the facility of turning might be greatly increased by making the roller or drum somewhat largest in the middle (or barrel shaped). The steam engine may be constructed in the same manner as those engines used for drawing carriages upon rail-roads, and may be applied to act within the drum in various ways.

In witness whereof, &c.

Specification of the Patent granted to JOHN STANLEY, *of Chorlton Row, Manchester, Smith, for certain machinery calculated for a more efficacious mode of fuelling or supplying of furnaces in general with fuel, whereby a considerable reduction in the consumption of fuel, the appearance of smoke, and of labour, is effected.* Dated July 27, 1822.

WITH AN ENGRAVING.

TO all to whom these presents shall come, &c. &c. *Now know ye,* that in compliance with the said proviso, I, the said John Stanley, do hereby declare that the nature of my said invention, and the manner in which the same is to be performed, are particularly described and ascertained by the following description thereof, reference at the same time being had to the annexed drawings, (see Pl. V.) in which said drawings the same letters or figures of reference are employed to denote the same thing, (that is to say:) The dotted lines, *a b, b c, c d,* represent a part of a boiler; *a b,* the top; *b c,* the end; and *c d,* the bottom of the said boiler; and as the bottoms of boilers are usually made convex upwards, *c d* represents the crown or highest part of the bottom: *e, f, g,* is a hopper or reservoir for coals, made of plate or wrought iron; *j i,* and *h g,* in fig. 1, are two plates of iron, forming the bottom of the hopper; the lower edges of these two plates are not brought together, but allowed to be about 3 inches distant from each other, so as to form an opening or slit all along the bottom of the said hopper, in the direction of *j g*, in fig. 2, in order to allow the coals to fall through the said opening: A, in fig. 2, shows an end view of the said boiler; *k l*, in fig. 1, are two rollers, placed immediately below the opening in the bottom of the hopper, so as that when the coals fall through the said opening, they may fall upon or between the said rollers. These rollers I usually make 6 inches in diameter, and of a length corresponding to the width of the fire-place or grate to which the said machinery is intended to be applied; and I make the length of the opening or slit in the bottom of the hopper also to correspond with the length of the said rollers. The rollers, *k l*, (as represented in the drawings, figs. 1 and 2) are fluted; there are ten flutes in each roller, and each flute is 1 inch in depth. These fluted rollers are employed for crushing or breaking the coals, and for equalizing the quantity required for the supply of the fire, in equal and successive periods of time. The absolute quantity of coals required to be supplied in any given space of time is regulated by the number of revolutions made by the said fluted rollers in such space of time, and by the distance at which the said rollers may be placed from each other. Motion is given to the said rollers by means which I shall hereinafter describe, and I regulate the distance between the said rollers by the ordinary and well-known method of applying adjusting screws and sliding brasses or bearings to the axle of one of the said rollers, as shown at *m*, in fig. 1: *w* is one of two pinions, by which one roller turns the other, as in common use. Immediately below the aforesaid two fluted rollers, I place what I shall hereinafter denominate a fan; it is composed of an iron axle or spindle, *n n*, in fig. 2, lying horizontally and parallel with the aforesaid fluted rollers. Two or more sets of arms (as the length of the fan may require, two only are required for the length exhibited in the drawings) are fixed or hung upon the axle, *n n*, as shown in fig. 2; each set of arms has three points. These arms are shown in figs. 1 and 2, at *o o*, &c. Upon the points of these arms I fix, by screws or rivets, three flat plates of wrought iron, *p p p*, of the same length of that of the aforesaid fluted rollers, of the breadth of 3 inches, and about one-eighth of an inch in thickness, so that the outside edges of the said flat plates or vanes, when turned round upon the axle, *n*, shall describe a cylinder of 16 inches in diameter. I enclose the aforesaid fluted rollers and fan in an iron case, of the shape represented in fig. 1, by the double lines, *g r s*, so as to exclude the air externally as much as possible. On the side next the boiler and fire-place I leave a rectangular opening, of the same length as the fan, and about 9 inches in height, from *s* to *u*, through which the coals are to be thrown by the fan on to the fire. I place the axis, *n*, of the fan, at the same height as the bottom of the boiler, represented by the line, *d*, *c*; and at the distance of 2 feet from the end of the boiler, denoted by the lines, *c*, *d*. The vanes, *p p p*, are made to revolve in the direction of the arrow, shewn in fig. 1, between *r* and *s*; each vane will pass the bottom of the case at the distance of one quarter of an inch, and at the distance of about 3 inches from the front of the case, near *r*, where an horizontal line, drawn through the axis of the fan, and at right angles to it, would meet the circular part of the case, near *r*: D is the fire-door, made in the usual way, and is placed opposite the grate: B represents a part of one of the grate or fire-bars, in figs. 2 and 3: E is a screw (usually called an endless screw) of 4 inches in diameter, with a single thread fixed upon the axle of the fan: F is a wheel 9 inches in diameter, having 28 teeth, working or taking into the thread of the aforesaid endless screw, E. The said wheel, F, is fixed or hung upon the spindle, I; and upon the said spindle, I, is also hung another endless screw, similar to the one E: H is a wheel hung upon the axle of one of the fluted rollers, and is similar to the wheel F: the said wheel, H, is turned by the endless screw, G. I cause motion to be given to the fan by either toothed or band wheels, as I may find it most convenient in procuring the moving power from some part of the machinery of the steam engine or other machine, which I may have an opportunity of employing for giving such motion; and to this end, I fix a wheel upon the axle of the fan, as is shewn at U, in fig. 2, taking care that the diameters of the wheels, and the velocity of the machine by which I am to give motion to the fan, be such as to cause the said fan to make two hundred revolutions per minute, or thereabouts. I have found that such a velocity will effect an uniform distribution of coals over a fire of 5 feet 6 inches in length. The relative velocity of the fan and the fluted rollers are as seven hundred and eighty-four is to one respective; that is, the fan makes seven hundred and eighty-four revolutions whilst the fluted rollers make one revolution. Machinery of the dimensions hereinbefore described, would answer the purpose of supplying coals to a fire capable of working a steam-engine of from thirty to forty-horses power; and for a less or greater power, or for a narrower or wider fire-place, the dimensions of the various parts may be altered accordingly. The velocity of the fan must also be less or more, as the fire may be shorter or longer. The hopper for containing the coals may be made of any dimensions, suited to the situation and purpose to which the aforesaid machinery may be applied.

From reading this specification, and examining the annexed drawings, the construction, operation, and use of the machinery hereinbefore described, will be clearly understood by any competent mechanic. Although I have hereinbefore described the whole of the machinery, in order that the nature of my invention, and the manner in which the same is to be performed, may be better understood, yet I do not claim the hopper, the fluted rollers, the fan, the wheels, screws, or any other part of the machinery, in their individual characters, as forming any part of my invention; all of them having been before invented, and used for a variety of purposes. But I do hereby declare that my invention consists in the employment and application of the fan, similar to the one hereinbefore described, in conjunction with the hopper, fluted roller or rollers, or with any other mechanical expedient capable of producing a regular supply of coals, so as that the coals so supplied may be, by the fan as aforesaid, thrown upon any fire or furnace.

In witness whereof, &c.

Specification of the Patent granted to Robert Dickinson, *of Old Eagle Foundry, New Park-street, Southwark, in the county of Surrey, for an improvement in the manufacture and construction of metal casks or barrels.* Dated October 7, 1824.

WITH AN ENGRAVING.

TO all to whom these presents shall come, &c. &c. *Now know ye*, that in compliance with the said proviso, I, the said Robert Dickinson, do hereby declare that the nature of my said invention, and the manner in which the same is to be performed, are particularly described and ascertained in and by the following description thereof, that is to say:—The object of my invention is to produce an improved iron packing case or barrel, for containing goods and provisions of every description, but which is more particularly intended for victualling the ships of his Majesty's navy, and others that make long voyages. The improvement consists, first, in coating and covering the iron, both inside and outside, so as to defend and protect its surfaces from oxidation; and secondly, to construct the cases or barrels in such ways as to render them convenient for receiving larger bodies than have usually been admitted by bung-holes; in other words, having a large opening, sufficient to allow a man's head, arms, and shoulders to enter, for packing large bodies therein with

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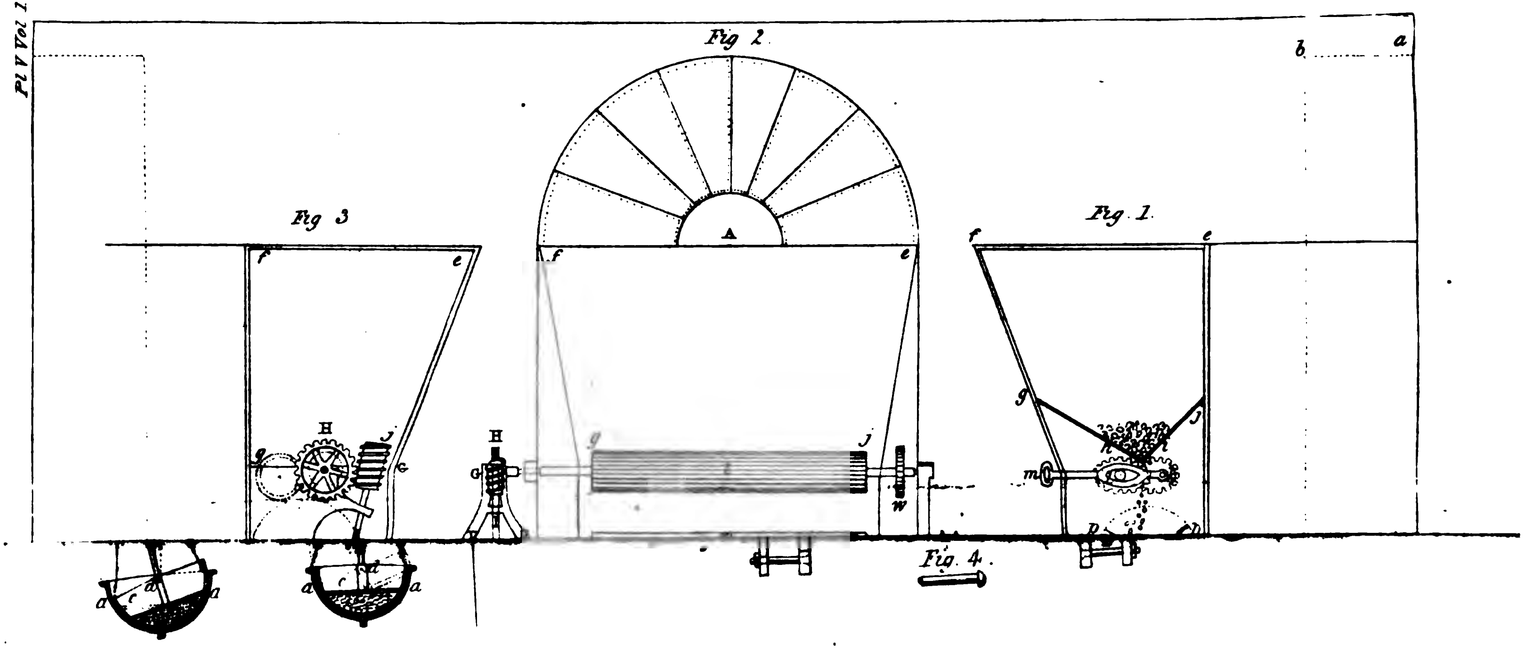

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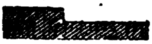
the greater convenience. My invention may therefore be said to consist of two parts, viz. the improved construction of the case or barrel, and the coating and covering of the iron. The manner, means, and materials whereby these objects are effected, are as follows. First, I will describe what relates to the construction of the barrel. The cylinder being formed in the common way, by rivets, soldering, or seaming, the manner of performing which is known to every workman, I make a hoop of iron, rolled, with one edge thin and the other thick; thus  (by some called a rebate). The thickest part of this hoop I fasten within the barrel, its thin edge extending to about one inch below the extreme end of the barrel, which being done, leaves a groove between the thin edge of the hoop and the barrel, see drawing. fig. 4, (Plate V.) *a a*, for the flange of the head to fit into. The groove being now rammed full of hemp, tow, curriers' leather shavings, a tar band, or any other similar substance, the head is put on its edge or flange, *b b*, falling into the packed recess. In order to render this head moveable at pleasure, it is supplied with a sufficient number of latch bolts (according to the size of the vessel), which latch bolts slide sideways into nicks, apertures, or openings, cut near the edge or end of the barrel to receive them; see fig. 5, *c c c*. These openings are formed somewhat out of a parallel line to the edge, so as to draw the head down the tighter when the side bolts are hammered into the holes; and also the latch bolts are made thinner at the end than at the shoulder, for the same reason. (See drawing.) I have been describing the moveable end, or that end which opens the reverse end is differently closed; it is indeed supplied with the same rebated hoop, but this hoop is to be placed about half an inch only from the end or edge, and then, when the head is laid on, or in its place, this half inch of the edge is to be bent over, and hammered tight down upon it. A flat ring, see fig. 6, *d d d* (which supersedes the necessity of a chime), is then rivetted down thereupon, so as to cover this joint, having a trifling projection to defend the barrel in rolling. The head may either be flat, convex, or concave; the latter I think the best. Having described the construction of the improved part, as relates to the mere barrel, I next come to the coating or covering thereof; first, for its own preservation, and secondly, for the preservation of whatever it may contain, from the rusting or oxidation thereof. To render this process of coating the most perfect and complete, the iron should be pickled or scaled, and scoured in the same way as for tinning; but when time cannot be allowed for this process, or where cheapness more than durability (to send abroad) is the object, I omit this scaling part, and content myself with laying the composition and cloth with which I intend to cover the barrels on the unscaled plate. In some cases I coat and cover only the outsides, as not being necessary to coat the inside of barrels containing tar, oil, varnish, &c.; and as for the inside of barrels intended to contain other substances, the great variety of chymical decomposing effects produced thereby, compels me to have different internal coatings, and to change them in some instances, according to the nature and quality of the commodity they are to hold; and as for dry products, such as bread, rice, pearl barley, flour, &c. where it is necessary to provide against the injurious effects of weevil, rats, maggots, or other living animals, and where the iron is not at any time exposed to wet, and where, therefore, an insoluble composition is not necessary, I apply a simple adhering or connecting material, such as glue, or a well-made paste, and the very thinnest and cheapest canvass or cloth that can be found, and sometimes paper; hence it is to be observed, I do not confine myself to any single article of paint, varnish, or cement, or by whatever name it may be called, or any of the articles from which they are made, whether simple or compound; meaning to lay claim to the exclusive employment of all soluble, insoluble, or impervious cements, in attaching fibrous substances to the surfaces of iron, for the purpose of preserving iron from rust, by covering with an intervening substance of a manufactured article or web, of any material or substance as aforesaid, whether of silk, cotton, linen, wool, leather, paper, or felt, however mixed or separate, from the thinness of a gauze to the thickness of a Turkey carpet or door mat, which, after saturating with any of the compositions suited for that purpose, and at a proper state of dryness, I pass between cylindrical rolls, in order to give it firmness and a consistency, with a capability to resist the admission of wet, or the influence and effects of chymical operations, arising from the various articles which the barrels or cases heretofore described may be used or required for. It may, however, be necessary to state definitely, what kind of cement will answer the above purpose. I shall therefore say, that I would take of caoutchouc (or Indian rubber) one pound, of black rosin half a pound, of Venice turpentine two ounces, and mix them together, allowing them to stand in a temperature of 160° for the space of twenty-four or thirty-six hours; the caoutchouc being cut into small pieces. In some cases I do not find it necessary to coat the insides of my barrels with the above materials; but to prevent rust, I bronze their internal surfaces in a similar manner to the surfaces of gun barrels.

In witness whereof, &c.

Specification of the Patent granted to Benjamin Rotch, *of Furnival's Inn, London, Esq. for an improved fid for the upper masts of ships and other vessels.* Dated Aug. 21, 1823.

WITH AN ENGRAVING.

TO all to whom these presents shall come, &c. &c. *Now know ye*, that in compliance with the said proviso, I, the said Benjamin Rotch, do hereby declare the nature of my said improved fid to consist in two levers, retained in a position to support the mast which is above them by means of two pauls, one butting against the carriage of each lever; or by means of two bolts, one passing through each lever and its carriage; the carriages in both cases being made of metal, and such levers being in both cases so placed as to admit of the mast above them being lowered without previously slacking the rigging attached to it. And in further compliance with the said proviso, I, the said Benjamin Rotch, do hereby describe the manner in which I perform my said invention, by the following description thereof, reference being had to the drawings annexed, and figures marked thereon, that is to say:

DESCRIPTION OF THE DRAWINGS.

Drawing marked A, fig. 1, (Pl. V.) is a side elevation of one of the levers of my said improved fid, with its carriage, one side of which carriage is supposed to be removed for the purpose of showing the relative position of the lever and its carriage when the mast is fidded. In this drawing, the parts coloured blue are to represent wrought iron, and those coloured otherwise, cast iron or brass*: L is a lever, turning on axis or gudgeons, X; on the under side of this lever is a paul, P, turning easily on the pin, *e*, and abutting against the back part of the carriage at *f*. The rod and ring at R are for the purpose of lifting up this paul when it is required to lower the mast that is above it: G G G is the carriage, the lower part of which embraces the trussel tree, the front leg being let into the trussel tree, flush with the square for the heel of the top mast, while the hind legs pass down outside the trussel tree: B is a bolt passing through the trussel tree, and fastening the legs of the carriage and trussel tree firmly together: T is the bottom of the carriage. Fig. 2 is a plan of the upper side of the lever and carriage. Fig. 3 is a plan of part of the under side of the lever, showing its appearance when the paul is removed. Fig. 4 is a plan of the paul, and fig. 5 is a section of the paul. Fig. 6 is a side elevation of the carriage, H being a hole for the purpose of getting at the paul to clear it in case of difficulty; and fig. 7 is a back elevation of the carriage. Drawing marked B, fig. 1, shows a front elevation of a top cross trees and trussel trees, with the head of a ship's mast, and the heel of a top mast, and a pair of the lever fids supporting the latter: F represents the line of the fid plate, which for the purposes of the said invention should be three times the ordinary thickness, because it will be seen that the point of the lever which goes into the heel of the mast is cut at an angle downward from the plate, so that the weight of the topmast may rest as near the gudgeons as possible, which arrangement (in case the outer fibre of the wood should turn up) will throw a great strain on the fid plate. Fig. 2 is a side elevation of a lever, to be kept in a position for supporting a topmast by means of a bolt passed through the lever and its carriage, instead of a paul; this mode of securing the lever I call the bolt lever fid, and the mode hereinbefore described I call the paul lever fid: with reference to the figure now describing, *t* is an arched slot, cut in the lever, and the curve of which arch is struck from the centre of the gudgeon, X, while two circular holes are bored in the carriage, opposite to this slot, and opposite to each other, and a bolt put through them. When the weight of the topmast is on the short end of the lever, the bolt is kept tight in its place; but when the long end of the lever is pressed down as far as the support, *i*, will let it go, the bolt is at once freed, and may be drawn out, when the weight on the short arm of the lever will force it down, and (the bolt being drawn away) the long arm will continue to rise till the short arm turns completely out of the fid hole, in the heel of the mast, and the mast will slide down beside it. Fig. 3 is an elevation of the opposite side of fig. 2, and fig. 4 is the bolt. Having now described the various parts of my said invention, I will proceed to explain the manner of putting the same in motion, for the purpose of lowering or fidding a topmast.

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* The colouring is unavoidably omitted in the engraving.

It will be observed, by attending to the arrangement hereinbefore described, that the mast will be supported on the short arms of levers, applied on the principle of steelyards, which turn on their axis at X. In the case of the paul lever, the use of which I am now about to describe, the long arm of the lever is kept from rising by means of the paul, which, by the weight of the topmast, is pressed so hard against the back part of the carriage at *f*, that it will not rise till freed from that pressure. In order to free the paul, the long end of the lever, L, must be pressed downwards, either by means of a burton or otherwise, till the part, *r*, of the lever, comes down upon the part, *s*, of the carriage, by which motion the paul will be advanced forwards from *f*, and may be pulled upwards by means of the rod and ring at R: while the paul is kept up in this position, if the long arm of the lever be suffered to rise, the weight of the mast will cause the short arm to descend, till it comes completely out of the fid hole, when the mast may be lowered away by the top tackle pennants. The mast being lowered, the operation of fidding is performed as follows:—The mast is hoisted up by the top tackle pennants till the fid hole is fairly in sight, when the short arms of the levers will enter into it, and a burton or other purchase being applied to draw down the long arms of the levers, the mast will be forced up into its place; while the paul, P, the moment it has passed down the inclined plane from *f*, will fall into the position shown in fig. 1, drawing A, and keep the topmast in its place. The manner of applying the bolted lever fid is nearly similar to the last-mentioned, except that when it is required to lower the mast, the long arm of the lever is pulled down till the stud, *i*, which is tapped into the under part of the lever, comes down upon the bottom part of the carriage, when the bolt, fig. 4, drawing B, may be drawn out, and the long arm being suffered to rise, the mast will descend as before; and when it is required to fid the mast, the long lever being again pulled down till the stud, *i*, touches the bottom of the carriage, the bolt may be easily replaced, when the force applied to the long arm of the lever being removed, the pressure of the topmast on the short arm will bind the bolt so tightly against the front part of the slot, that it will be kept steadily in its place. It will be observed, that in the carriage for this bolted lever fid, no inclined plane or back step will be required. The said improved fid, as shown in the drawing marked A, represents the main top gallant fid of a vessel of about 300 tons, half size; and these shown in the drawing marked B, represent the fore topmast fids of a frigate, of about 1000 tons, drawn to a scale of one inch to a foot. Now whereas a lever or levers may have been used heretofore, for the purpose of assisting to raise a topmast to its place; but two such levers as aforesaid, fitted with metal carriages as aforesaid, and applied for the purpose of fidding and unfidding the upper mast of a ship or other vessel, and retained in a position to support such upper mast by means of two pauls, one attached to each lever, and butting against the carriage of the said lever, as hereinbefore described, or otherwise, by means of two bolts, one passing through each lever and its carriage, as hereinbefore also described; and by means of which said levers a mast, having been first fidded with them, may be unfidded, without previously slacking the rigging attached to it, being, to the best of my knowledge and belief, entirely new, and never before used in these kingdoms. I do hereby declare this to be my specification of the same, and that I do verily believe this, my said specification, doth comply in all respects fully, and without reserve or disguise, with the proviso in my said hereinbefore in part recited letters patent contained, wherefore I do hereby claim to maintain exclusive right and privilege to my said invention.

In witness whereof, &c.

Description of balanced or swinging masts, to be applied to sailing boats and other light vessels, invented by Mr. Raphael Clint.

From the Transactions of the Society of Arts, &c. Vol. XLII.

The sum of Twenty Guineas was voted to Mr. Clint for this invention.

WITH AN ENGRAVING.

The inventor has for some years past been connected with nautical science, as a pursuit of pleasure, mostly on the boisterous west coast of Scotland; and he is fully aware of all the vicissitudes to which vessels are exposed, and has a correct knowledge of their tactics.

This invention, now offered to the Society of Arts, &c. was originally intended for open boats; but, on trial, it appeared that, under the various modifications of which it is susceptible, it may be most advantageously adopted for decked vessels, being particularly well adapted to the use of such of them as are employed only for fast sailing, without regard to the carrying of cargoes. Of this class are revenue cutters, mail packets, pilot boats, pleasure boats, and others; and when the many important advantages resulting from the invention shall become known, none of these will refuse to make the allowance of the space required for the cradle, which will be about the same as that occupied by the engines of a steam boat. One of the objects of this plan is to enable a vessel under a press of sail, *close hauled*, to preserve an upright position upon the water. The advantages of which position are,— 1. The vessel will sail faster by dividing the water better at the bows, and by drawing less dead water at the stern. 2. The vessel will answer the helm much better. 3. The vessel will go better to windward in that position than in the awkward state of sailing upon her side. Another object is to prevent the loss of lives and property consequent upon the frequent upsetting of vessels in squalls of wind, or by inattention or fool-hardiness; for a vessel on this construction is found on trial to maintain her upright position, however violent the wind.

The model before the Society is that of a sailing vessel, six feet long, and only *nine inches broad*; of which the following is a brief description. In her hold, a semicircular cradle is suspended on the centres between two beams; in this cradle is placed a quantity of ballast, or part of cargo; in the cradle the mast is raised, and to the sides of it are fixed all the rigging, haul yards, &c. the whole being decked in: in other respects there is no material difference above deck from ordinary vessels. A boat on this construction is enabled to carry nearly three times the common quantity of sail *close hauled*, and from its great length of shape sails with proportionably increased velocity; and however violent the pressure of the wind, the *hull* of the vessel always maintains an upright position in the water.

The preceding remarks have reference only to the application of this principle to vessels of the ordinary form; but a more important advantage, as far as relates to fast sailing, results from this construction, consisting in the diminished breadth of the vessel. The proportion of length to breadth in the model before the Society is as seven to one, and the ordinary proportion is as three to one, by which four-sevenths less of resistance is given to the progress of this vessel through the water, giving her four-sevenths of accelerated velocity in sailing.

Length, if it can be applied, is a great desideratum: it enables a vessel to go over a heavy sea with ease and speed, by making the angles of elevation and depression upon the waves less acute: it makes a vessel sail more steadily, and hold a good wind: it enables a vessel to lie at anchor and ride out a gale in greater safety, by diminishing the strain upon the cable.

To all these advantages the plan has the merit of extreme simplicity. Every stay, haul yard, brace, sheet, tackle, and sail, is in the same place as in an ordinary vessel; and consequently, in manning a vessel on this principle for sea, the sailors would have *nothing new to learn*.

In conclusion, it may not be impertinent to remind the

Society of the various means adopted by the natives of the shores of the Pacific and Indian oceans to make their long canoes carry sail.

There are the double canoe, the catamaran, the canoe, with bamboo canes placed out upon cross poles, and the canoe with one side flat, and a man out to windward upon a spar; these serve to exemplify the utility of length, but are fit only for an amphibious people, and are practicable only on a small scale.—See *Lord Anson's description of the Flying Proas of the Ladrone Islands.*

Raphael Clint.

In the month of May last a whale-boat was fitted up by Mr. Clint according to the above plan, and several experiments were made on her in the river Thames; on one occasion she sailed down to Erith with a full spread of canvas, and upon nearly an even keel, at a time when, from the boisterousness of the wind, the Gravesend and other sailing boats were working under reefed sails, and running nearly gunwale to. Of the novelty of Mr. Clint's plan, and its practicability to at least a certain extent, there appears no doubt; and therefore the Society have thought themselves justified in offering it to the attention of the public, without, however, pledging themselves that in its present state it is applicable safely and usefully to marine navigation.

Reference to the engraving.

Fig. 13 (Pl. V.) represents the relative position of the mast and hull before sail is set.

Fig. 12 represents the same when the vessel is under a press of sail close hauled.

a The hull. *b* The mast attached to the cradle, *c* : the lower part of the cradle is partitioned off to contain the ballast. *d* One of the pivots, by means of which the mast and cradle are suspended, allowing them to swing laterally, while the hull preserves its upright position.

New mode of supporting the topmasts of ships, invented by Mr. G. Smart, *Pedlars' Acre, Lambeth.*

From the Transactions of the Society of Arts, &c. Vol. XLII.

The Gold Vulcan Medal of the Society was presented to Mr. Smart for this invention.

WITH AN ENGRAVING.

The common mode of supporting a topmast is by means of a fid, or bolt, of iron or wood, which passes transversely through the mast near its base, and rests, by its two ends, on the tressel-trees, which form part of the top or framework of timber, which, together with the cap at the head of the lower mast (through which, also, the topmast passes), supports this latter in a vertical position. It is also supported laterally, in two opposite directions, by the shrouds, which are strong ropes fixed at their lower end, some to the side of the vessel and some to the top of the lower mast, and all of them secured, at their upper end, to the head of the topmast.

In heavy gales, when a vessel is under weigh, or at anchor, the impulse of the wind against the mast is such that it acts like a power applied at the end of a very long lever to bury the lee side of the hull in the sea. The obvious remedy for this would be to lower or slide down the topmast, and thus to reduce the length of the lever; and, to a person unacquainted with practical navigation, the only operation apparently requisite for this purpose would be to knock out the fid, and then to lower the topmast through the interval between the two tressel-trees.

The weight, however, of the topmast, with all its appendages, occasions so enormous a pressure on the fid that it is found quite impossible, by any power which can in that situation be applied, to drive out or withdraw the fid without previously taking off the pressure. This is done, or rather attempted to be done, by attaching a rope to the heel of the topmast, leading it through a block hooked on to the cap of the lower mast, and then conveying it below to the windlass, or any other power that can be most conveniently made use of. But as in gales of wind the shrouds are always drenched with wet from the spray and the rain, and as a dry rope always shortens by being wetted, it follows that the tension of the topmast shrouds is at such times acting in the same direction as the weight of the topmast, and in direct opposition to the heel rope, on which account it rarely happens that the fid can be relieved.

The tension of the shrouds may indeed be taken off by slackening them; but, in proportion as this is done, the lateral support of the topmast is diminished, and the most imminent hazard is incurred of its being blown away. To lower the topmasts, therefore, while a ship is under weigh, however conducive it may be to the ease and even to the safety of the vessel, is a manœuvre not often successfully attempted even on board men of war, and scarcely ever on board merchant-men, which are always scantily manned.

The above-mentioned very serious objections to the common way of securing a topmast have induced Mr. Smart to propose the following plan, which, although as yet it wants the sanction of experiment, has been taken into consideration at two successive committees; and from its there obtaining the unanimous approval of naval officers and other professional men, is now offered to the public through the medium of the Society.

A little below the *hounds*, or shoulder of the lower mast, which supports the frame-work of the top, is to be formed a step, *f*, fig. 14, (Pl. V.) This may be done by bolting a fish to the mast in that part, if the mast is a single tree; but if built of several spars, as all large lower masts are, there will be no difficulty in making the step without the use of a fish. The face of the step is to be a plane declining outwards, and is to be strongly plated with iron or copper. A shoulder fitted to this step, and like it covered with metal plate, is to be cut in the heel of the topmast, *b*: the whole weight of the topmast will therefore rest on and be supported by the step in the lower mast, and as the area of the step will be at least equal to that of the top of the fid-hole, *h*, the one will be no more liable to crush in by the superincumbent weight than the other. In order to prevent the topmast from being thrown off its step by any lateral motion, a wedge, *g*, figs. 14 & 15, is driven between the topmast and the cross tree, *e*. The fid, *h*, is proposed to be retained, but only as a preventer in case of accident; for the bottom of the fid hole being placed an inch above the tressel tree, *d d*, it is manifest that it bears no part of the weight of the topmast as long as this latter rests on the step, *f*.

In order to strike or lower the topmast, the heel rope, with its tackle, is first to be applied, then the fid, *h*, is to be withdrawn, after which the wedge, *g*, is to be knocked out; and this will be done with comparatively little difficulty, because the lateral pressure of the mast cannot be much, and because any difficulty likely to arise from this cause may be obviated by proportionally increasing the angle of the wedge. Nothing now remains but the exertions of two or three men, with handspikes inserted between the two masts near the tressel trees, to trip the topmast off the sloping step, *f*, and to lower it in the usual way by means of the heel rope.

References to the engraving.

Fig. 14 is an elevation. Fig. 15 is a section.

a The upper part of the lower mast. *b* The lower part of the topmast. *c* The cap. *d d* One of the tressel trees. *e e* The cross trees. *f* The step on which the topmast is supported. *g* The wedge by which the topmast is secured in its place. *h* The preventer fid.

Observations on Mr. BROWN'S *Vacuum Engine.*

Communicated by a correspondent.

GREAT expectations have been excited in the public mind respecting this engine, the specification of which appeared in the 45th vol. of the Repertory of Arts, &c.; but of the wonders which it was to perform, none have yet, I believe, been exhibited in an operative shape; and we are still to look forward for the fulfilment of its mighty promises.

Many persons at first thought, that in it a real vacuum was to be produced, by burning pure hydrogen in the portion of oxygen proper to produce water; but it turns out that the word vacuum is used on this occasion in an improper sense (which probably caused this error), and that it is intended to denote a degree of exhaustion of the working cylinder of the engine, equal, at most, to a column of 23 or 24 inches of mercury, which is far short of a vacuum.

Coal gas, in this engine, is contrived to be burned in atmospheric air, to produce the degree of exhaustion of which it is capable (which I doubt much to be so great as stated). This, however, cannot proceed from the mere reduction in volume of the mixed gases burned, since coal gas, or carburetted hydrogen, burned in the proportion of 170 parts with 100 parts of oxygen, will produce 100 parts of carbonic acid gas, (*See Dr. Henry's paper on coal gas, &c.*) and as atmospheric air contains but 27 parts of oxygen in 100, of course the 73 hundredths of azote left will have to be added to the carbonic gas. Now as very nearly 373 parts of air will be necessary for the 170 of coal gas mentioned, there will remain, after the combustion, 272·29 of azote, and 100 of carbonic gas, in all 372·29 parts, out of 543, which is, within a very small fraction, one half of the whole quantity originally introduced.

It is evident then that the effect is not produced by the burning out, or condensation of the gases; but by the explosion of the mixture, or by the expansion caused by its flame, when this does not amount to what would be called an explosion, though in all cases it is a degree of it.

Here then we come on other grounds, which I am much surprised have not been noticed before in the many publications which have treated of this engine. In the 2d part of the 1st vol. of the Transactions of the Cambridge Philosophical Society (which were published considerably more than a year before the sealing of Mr. Brown's patent), there is an account given of an engine on precisely the same principles last explained, invented by the Rev. Mr. Cecil, of which account there is an extract published by Dr. Brewster, in the Edinburgh Philosophical Journal for October, 1822, (v. vii. p. 362) that may perhaps be more readily consulted, as being in more extensive circulation.

Of this extract the following is the substance:—"The principle of Mr. Cecil's invention appears to be, that a mixture of one part of hydrogen, and 2½ of common air, will expand, on being exploded, to three times its bulk, and then instantly collapse to a sixth of its original volume.

"A cylinder, with a piston and a light valve at its other end, is the chief apparatus. The hydrogen gas admitted into this, and exploded by a jet of flame through a touch-hole at the side, will drive out the most of the common air from the cylinder by the end valve, which will clap to by the condensation afterwards, and force down the piston, by whose action the other valves, which admit the air and the gas, are opened; when it again rises by the action of a counterweight, or of a fly wheel, and the same process is again repeated."

On this extract I will leave your readers to make their own comments; only premising that, as the invention was thus evidently first published by Mr. Cecil, whatsoever merit it has is that gentleman's undoubted right. And here I beg leave to state, that all engines, where explosive mixtures are burned, are most dangerous to the lives and property within their vicinity; and that the mixture of coal gas and air is eminently of this nature, we have too many common examples to need the statement of chemical facts. This must be the case; even where philosophical gentlemen carefully attend to the performance of such engines; what then must be the danger, when left to the management of ignorant labourers? which must, more or less, occur, if they come to be used as first movers for manufacturing purposes.

A paper by Mr. T. Tredgold, (which corroborates the foregoing statement) on the theory and power of this engine, and comparing the latter with that of the steam engine, has been published in a late number of the Edinburgh Philosophical Journal, wherein he has entered into some very minute algebraical calculations on the subject, which prove the inferiority of the former. Mr. T. shows that if oil gas is used with the gas engine, 270 cubic feet of it, at a cost of 10*s.* will be necessary to produce the effect of a bushel of Newcastle with the steam engine; and that if coal gas be used, that 482 cubic feet of it, at a cost of 5*s.* 9*d.* will only have the same power; which even in London, where coals are so dear, will be nearly five times the expence that a steam engine would require in doing equal work.

If worked with oil gas, Mr. T. thinks that a jet of flame, of a temperature equal to 1050°, might be made to fill a cylinder of a small size, and produce an exhaustion capable of sustaining a column of mercury of 20 inches (which, however, is not two-thirds of what a real vacuum would perform); and concludes with observing, that "the advantage of this increase of moving force is, however, not so great as to repay the increased consumption of gas necessary to produce it; and that the exchange of steam boilers for the retorts and gasometers of a gas work, will certainly not be esteemed an advantage; while, for a locomotive engine, the expence would be so great as to put it entirely out of the question, whether it would be better to carry oil gas, compressed to a 30th of its bulk, or to use a high pressure steam engine." B.

Remarks on a paper inserted in the Philosophical Magazine, by Mr. Wm. Herapath, *on a compensating pendulum.* By a Correspondent.

Mr. Herapath, in a paper inserted in the Philosophical Magazine, No. 325, calculates, from experiments which he recites from several good authorities which he names, that if a pendulum be constructed as usual, of three inches of watch spring, and the remainder of iron wire, that its expansion for 1° Fahrenheit will be—

3 inches steel, ·000022830
36·139290 iron, ·000250600
·000273430

which would be counteracted by that of 16·35 of zinc. But as this cannot be applied without adding more iron, the zinc must be increased by so much as will also counteract that addition; and yet the zinc must not be greater or less in length than the iron added, the exact quantity of which Mr. H. computes to be 27·92 inches.

The expansion of the pendulum rod will then be, for 1° Fahrenheit,

3 in. steel, ... ·000022830, & of 27·92 in. zinc, ·000466822
36·139200 iron ·000250600
27·92 iron, ... ·000193542
·000466972

Having thus determined the length of the zinc necessary, Mr. H. thus applies it. The pendulum rod is made as usual in common clocks, with three inches of steel spring attached to an iron wire, having a foot firmly fastened to it; a tube of zinc, 27·92 inches long, is slid over this rod, and fastened to the foot; an iron tube is now put over this zinc tube, and at the top is fixed by a screw to the top of the zinc tube. The bottom of the iron tube is connected with the pendulum ball. Here ends Mr. H.'s account, with a reference to a figure given in the original, which he states will give a better idea of the instrument than any verbal description.

In this figure, besides the parts above mentioned, there are two screw collars represented, one at the top of the zinc tube, and the other at the end of the iron one, for regulating their length; and a piece of wire descending from the collar at the bottom of the iron tube to the bottom of the pendulum ball, where it terminates in a screw; a nut turned on which supports the ball and shortens or lengthens the rod as required.

It seems strange that the author, who appears to have paid great attention to the precision of his calculations, should have made such a material error in the description of the execution of his plan, as to have directed the last-mentioned wire (which connects the bottom of the iron tube with the bottom of the ball), to be added to the rest, without having made any allowance for its expansion downwards. I can scarcely suppose, however, that he could have intended that this wire, which is a fifth of the length of the steel spring and first wire of the pendulum taken together, should have been added to the entire length, as that would have made the pendulum near 47 inches long, though his direction that "the pendulum rod is to be made as usual in common clocks," to whose end the foot is to be fastened to support the zinc tube, certainly bears that meaning; for if made as usual, it must be, together with the steel spring, 39·1392 inches long; but in matters of this nature, which depend on exact proportions, this inaccuracy of description is at least improper. On this last supposition I will take the liberty so far to correct the description, as to advise that the steel spring, with the wire from it to the bottom of the zinc tube, and the wire from the bottom of the iron tube to the bottom of the ball, be collectively of the length of an ordinary pendulum.

Mr. H. has also neglected to make any allowance for the expansion upwards of the ball of the pendulum from the nut which supports it. This error I will also remedy for the author, by recommending that the nut be placed in the centre of the ball, as has been already practised by careful artists, instead of at its bottom, as the figure directs.

From an account of a tubular compensating pendulum, made by the late Mr. Patoureaux, clock-maker, formerly of Wardour-street, it appears that tubular pendulums were made as early as 1775. Mr. Troughton also published an account of one made by him in 1808. Mr. Herapath's is, however, different from any of these, in the materials and their arrangement, and probably would succeed as well as the best of them, with the corrections before mentioned.

But I conceive that there is a course of inaccuracy in the very nature of tubular compensating pendulums, which renders them inferior to others of a different construction; for in them the tubes and wire, or metallic rod, of which they are composed, consisting of very differently sized masses of matter, and with different exposures to the air, cannot be effected simultaneously by the atmospheric changes of temperature. For example—the wire, having a great surface in proportion to its solid contents, will more rapidly come to the temperature of the air on a rise of the thermometer, than the tubes; and of those the internal one, being moreover, as it were, clothed by that which is external, will change its length more slowly from the same cause, which must produce an irregularity in their compensating effects.

These considerations should by no means be esteemed fastidious niceties, as some may affect to call them, since the great point in question in such contrivances is evidently precision; and where that is immaterial, a cuckoo clock, with its rusty wire and wooden bob, may perhaps do as well as more expensive machinery.

W.

Method of making transparent Soap.

From Archives des Découvertes et des Inventions Nouvelles.

Tallow is the basis of all soaps for the toilette, known under the name of Windsor, because olive oil forms a paste too difficult to melt, and having an odour too powerful for mixing with perfumes.

Tallow-soap, dissolved with heat in alcohol, returns to its solid state on cooling. It is this fact which has led to the discovery of transparent soap. When well prepared, this soap should have the appearance of fine white sugar candy. It may also be coloured, and vegetable colours are, for this purpose, preferable to minerals. Any person can make this soap by putting into a thin glass phial half a brick of Windsor soap, cut small, filling the phial half full of alcohol, and placing it near the fire till the soap is dissolved. This mixture, put to cool in a mould, gives the transparent soap.

On the employment of the wood and bark of the chesnut-tree in dyeing and tanning.

From Annales de l'Industrie Nationale.

The bark of the chesnut-tree contains twice as much tanning matter as oak-bark, and nearly twice as much colouring matter as log-wood. The colouring substance of chesnut-bark is to that of campeachy log-wood exactly as 1·857 to 1.

Leather prepared with this substance is more firm and solid, and yet more supple. This bark is the best substance for making ink: mixed with iron it becomes a bluish black. The liquor drawn from this bark appears blue at the outside, like indigo; but it gives, on paper, the finest black. In dyeing it has a greater affinity for wool than sumach has, and in other respects it differs very little from sumach and gall-nuts. The colour obtained from this substance is unchangeable by air and light.

NOTICES OF NEW PATENTS.

Patent granted to Messrs. SAMUEL DENISON *and* JOHN HARRIS, *of Leeds, for improvements in machinery for making wove and laid paper.* Dated January 1, 1825.

THE principal parts of this apparatus are, 1st, a reservoir or vat to contain the pulp; 2d, a trough to convey it to this vat from the vessels, &c. wherein it is prepared; 3d, a large hollow revolving cylinder, whose surface is formed so as to have the effect of the wire moulds used in paper-making; 4th, two endless felt webs, each revolving on a pair of rollers, lying in a horizontal position, and placed one above the other; 5th, a pair of smaller rollers, one placed in the interval of one of the webs, and the other opposite to it in that of the other web, where their axles are pressed together by screws, in order to press the water out of the pulp, as it passes between them along with the felt webs; 6th, another roller, placed beneath the felt roller of the lowest web, which is next the vat, and against which roller it is pressed by screws at its axle, to force the water out of the felt as it passes between those two rollers; 7th, a reel to roll up the paper as it is formed, which reel is placed of course at the furthest extremity of the apparatus from the vat; 8th, a very small and light roller, placed between the felt web rollers and the paper reel, whose office is to prevent the paper from sticking to the web; and 9th, a revolving frame within the vat (called a *hog* by paper makers), which by its motion keeps the pulp properly mixed up for use.

The vat for the pulp is hollowed beneath, in front, to admit the large hollow moulding cylinder to enter, so that the pulp may pass out from its upper edge on the surface of the cylinder, about half way between the vertical and horizontal planes of its axle. The revolution of the moulding cylinder brings the pulp in contact with the upper horizontal felt web, which lies nearly in the horizontal plane of its axis, at the opposite side from the vat; and in conveying it there from the vat; drains a considerable portion of water from it by its cribriform surface. The roller of this felt web, that lies next the moulding cylinder, is pressed against it by screws at its axis, so as to cause the pulp to adhere to it sufficiently to pass downwards along with it to the middle pressing rollers before mentioned, which nearly presses the rest of the water from it, and are therefore called the wet rollers: from thence it passes on between the upper and lower felt webs, to the pair of rollers furthest from the vat (where the two webs separate to return in opposite directions to the other rollers), and where it is again pressed by screws between those rollers, and thereby made sufficiently dry to be separated from the felt in a continued sheet, for which cause these rollers are called the dry rollers; and from them the sheet is taken by the little separating roller, and passed on to the reel, which, when full, is removed to the drying loft or stove; an empty one being always at hand to supply its place.

The upper and lower felt webs are only in contact between the wet rollers and the dry rollers; their two other rollers, next the vat, being set sufficiently apart to permit the webs passing in that place without touching.

Besides the nine rollers mentioned, the patentees use others covered with brushes, placed beneath the lowest felt web, to brush off any particles of pulp which may adhere to it.

A shaking motion having been found essential to the formation of the pulp into paper, when in the moulds, this is given in this apparatus, by making the legs jointed, which support the frame that contains the rollers, and by having a crank connected with the frame at one side, whose revolution gives the degree of concussion desired.

The motion from the mill shaft is first given to the dry or delivering rollers, and from them communicated to the other moving parts by suitable machinery.

To complete the account of this apparatus, we have now to describe the composition of the moulding cylinder

This is formed of several metal wheels, placed on the same axle, about five inches asunder. The rims of the outermost of these wheels at each side are of greater diameter than those which are intermediate, so as to extend sufficiently beyond them to allow of a groove for the reception of the ends of the small cross bars, which form the surface of the cylinder into a mould; and also to rise above them into a ledge at each side of the cylinder, about half inch high, similar to the deckles of the paper moulds, and for the same purpose of confining the pulp from passing off at either side. The small cross bars mentioned are made of copper plate, set edgeways in the plane of the radii of the cylinder across from side to side, and at right angles to the wheels, which form its internal framing. They are about three-eighths of an inch broad up and down, and of the length of the breadth of the cylinder, and have small projections on them at one side, at intervals of three-quarters of an inch (called nibs by the patentees), and of the same thickness as the bars. It is obvious that those little projections will keep the bars asunder when pressed towards each other on the rims of the wheels, sufficiently to form the surface of the cylinder (which their addition to its other parts completes) into a sieve-like form, similar to that of the common paper moulds, and capable of equal fineness. This arrangement of these bars of course goes all round the wheels, or disks, described, so as to entirely cover them, and form the surface of the cylinder. The ends of the bars are secured by the grooves in the outside disks or wheels, as mentioned; and where they cross those which are intermediate, they are fastened to them by soft solder, probably at the inside.

When paper is required narrower than the whole breadth of the cylinder, the interval between the external rims is reduced by endless straps, placed on the cylinder at distances suitable to the size of paper required, and so as to form moveable deckles.

The moulding cylinder described will form paper with the common water-mark; and in order to enable it to make wove paper, it is directed to turn little grooves or lines, on the outside of the upper bars, forming the surface of the cylinder as mentioned, and at distances from one another equal to the intervals of these bars, which the patentees aver will be sufficient to produce the smooth face required for that species of paper.

This seems a very compact and well-contrived apparatus for the purposes designed. In several particulars, however, it much resembles the machinery for which Messrs. Fourdrinier and Gamble obtained patents at different periods, [the term of which was extended 15 years by Act of Parliament, August 14, 1807, whose specification is inserted in the 13th vol. of the second series of the Repertory of Arts, &c. page 217]; but is as much remarkable for its simplicity as that was for its complication, and vast number of parts.

The moulding cylinder is also very similar to one which is described in the specification of the late Mr. Joseph Bramah's patent for improvements in the art of paper making, sealed 25th April, 1805, which may be seen in the 8th vol. of the second series of the Repertory of Arts, &c. page 1, but certainly is of an improved construction; for Mr. Bramah's cylinder was only covered with wire, worked over like the surface of a common paper mould, and supported by cross bars underneath, in the same manner, which is by no means so strong or substantial a mode of covering it as that of the patentee's, nor in any respect equal to it in ingenuity of contrivance.

This apparatus for making paper may therefore be considered as originating from the patent inventions of Messrs. Fourdrinier and Gamble, and of Mr. Bramah for the same purpose, but containing substantial improvements, and excelling them in the particulars mentioned.

Patent granted to Mr. Pierre Erard, for improvements in pianofortes, communicated to him by a foreigner. Dated January 5, 1825.

The inventions comprised by this patent relate, first, to means of strengthening the wrest-board, to prevent its being twisted and distorted by the great tension of the strings, and also to prevent this cause from operating in a similar manner on other parts of the frame of the instrument; and secondly, in new arrangements for the parts that communicate the impulse of the key to the hammer.

The method which the patentee directs for effecting the first-mentioned object is, to fasten sheet iron plates on the bottom and the side of the wrest-board by screws, and to extend straight pieces of bolt iron across the inside of the frame of the piano, in five or six places, at equal distances, which (according to the drawings of the specification) are crossed by others which run longitudinally, and thus form, by their sections, a number of compartments of the shape of oblong squares. Some of these bracing pieces have screws at their extremities, acting outwards, to regulate the thrust in the parts where they act.

The second object of the specification is effected by attaching to the farther end of the key those pieces which communicate its motion to the hammer, and which usually are arranged in a different mode. These are of a very complicated composition, some containing seven and some eight parts, including a spring, rising vertically over the key; besides which, there are other pieces fixed to the key, for acting on the dampers.

There are directions given in the specification, with very good figures, for applying these inventions to upright pianos, as well as to those which are horizontal, of which we shall only notice that the keys of the former are bent downwards at about two-thirds of their length into an angle of about 45 degrees; and that the joint or centre of motion, instead of being at the angle, is fixed between it and the front.

If strength and stability were the chief objects for this instrument, then would we say that the above inventions for this purpose were great improvements; but as the tone of the piano is a primary point, we must hesitate in commendation, greatly apprehending that so much iron work, and so many stiff braces, must destroy those fine vibrations of the wood, on which its excellence depends. In a violin, every one knows what a sad effect such braces and platings of iron would produce, and how they would transform it from an instrument of music to an instrument of torture, at least to an ear of any delicacy of sensation; and we can see no cause why they should not produce, in some degree, a similar effect on the pianoforte.

We also object to the apparatus placed on the ends of the keys to act on the hammers, both on account of the weight which they must add to the keys in fingering, and for their complication, and inadequate fastening to the keys, which must render them liable to perpetual derangement; while the increase of workmanship, which they would cause, must add greatly to the price of the instrument, already sufficiently costly.

The keys of the upright pianos, described by the patentee, have the above defects, if possible, worse than those of his horizontal instruments.

Patent granted to Messrs. GEORGE SAYNER *and* JOHN GREENWOOD, *for improvements in the mode or manner of sawing and cutting wood and timber by machinery.* Dated January 11, 1825.

THESE improvements consist in placing circular saws above and below the timber that is to be sawed, one a little behind the other, so that their edges may pass its central line, and thus cut it quite through.

A number of these saws, placed on the same axis, and separated from each other by flanches of the thickness of the pieces required, are used in this manner to cut several boards at once from one piece of timber; and for cutting scantling there are added, at the sides of the timber, horizontal saws on vertical shafts, arranged in a similar manner.

To rasp log-wood and other dye-woods, a number of circular saws are placed *close together* on one axis, and their joint action, when used, cuts the whole wood into saw-dust. The shape of the teeth of the saws for this last purpose, which the patentee calls the "half diamond" form, presents the figure, when seen sideways, of angles of 45 degrees, one side of which lies in the line of the radius of the circular saw, and when viewed endways, exhibits the form of so many chevrons (as they are called in the language of heraldry), by which they constitute a number of pointed edges for acting on the wood, similar to a species of chissels used very commonly in turning, and also resembling the points of the common graving tools used in copper-plate engraving.

The apparatus used for moving the timber towards the saws is formed of a number of rollers with axles, placed in a horizontal line, at equal distances asunder, on which the timber is laid. Of these the roller next the saws is moved round by the same machinery which turns the saws, with the lesser degree of speed necessary in impelling the timber. Above this roller and the timber, is placed another horizontal roller, which is made to press the timber against the lower roller by two vertical pieces that ascend from the ends of its axle, across the tops of which another shorter piece is laid, over which a horizontal lever passes that is jointed to a post at one end, and has a weight appended to its other end, which, to give it more power, is three or four times more distant from the cross piece than is the centre of motion. A large vertical drum wheel is placed above the whole, from which leather bands or straps, passing to pulleys on the impelling roller, and the shafts of the circular saws give the one the motion requisite for moving on the timber, and the others that for cutting it.

Circular saws have now been so long in use, and have been applied to such a number of purposes, that it is scarcely probable any new application of them can remain to be adopted, and open to the exclusive right of a patent.

In Mr. Samuel Bentham's very voluminous specification of the patent granted to him, April, 1793, (for which see Repertory of Arts, 1st series, vol. X. p. 21,) a numerous variety of modes of using circular saws, for a great many different purposes, may be found, which, both as to position and combination of these instruments, leaves it scarcely possible to add any thing new.

We fear, therefore, for these reasons, that the apparatus of the patentees, however ingenious and effectual it may be, can have but little claim to the exclusive monopoly of a patent.

Patent granted to Mr. JAMES FALCONER ATLEE, *for a process by which planks and other scantlings of wood of every description will be prevented from shrinking, and be improved in their durability, closeness of grain, and power of resisting moisture, &c. &c.* Dated January 11, 1825.

IN this process the wood is first to be sawed into the planks or square scantlings wanted, with the sides parallel to each other, and then to be planed; which afterwards are to be passed between metal rollers several times, the rollers being screwed closer together each time. For the same purpose several pairs of rollers may be used, arranged in a line, and successively closer together as more remote; the passing the scantling through which will save time, and prevent the necessity of altering the screws, which force them closer together, so frequently. In this operation the sap of the timber is pressed out, and visibly exudes from it, and the wood shows but little tendency to swell again, even when wetted, and becomes harder, heavier, and closer, and less liable to wear or decay.

It is necessary to increase the pressure of the rollers gradually, for if this is performed too rapidly the wood will be split and otherwise injured. It is not possible to lay down precise rules for the degree of pressure, as the different kinds of wood require different management in this respect.

For trennels, or coaks, the wood is to be first sawed square of the size required, after which its angles are to be planed off; and it is then to be forced forward by any adequate power, through several conical holes in steel plates, successively smaller than those used precedently, in a similar manner to the process used in drawing wire, except that the action of pushing is used instead of drawing.

By the operation described the patentee asserts, that Honduras mahogany may be made nearly as close and solid as that of Jamaica: and if one of the rollers be polished, will have the side next it polished also. He moreover states, that this process will greatly improve timber for ship building, and for other building purposes; for the construction of furniture, and for all other uses where close and compact wood is desirable; thinks that wood thus prepared will be found so useful as to become a new article of manufacture and commerce, and proposes to give it the appellation of *condensed wood*.

In May, 1812, Mr. Smart, of Westminster Bridge, obtained a patent for preventing wood from shrinking, by rollers and other means of pressure, in a similar manner to that of the patentee, the specification of which is inserted in the 22d vol. of the second series of the Repertory of Arts. The principal use which Mr. Smart made of this process was, in manufacturing staves for small casks, and foı the species of soldiers' canteens made of coopers' ware.

It is evident that planks or scantling only can be used to good purpose in this process, which are quite free from knots; since the grain of knots running across that of the timber, and often at right angles to it, would form an insuperable obstacle to the proper action of the rollers where they occurred, and not only make the pressed wood uneven in its shape, but in many cases cause it to split in two or more pieces, especially where the knots lay obliquely, and in some instances would stop the action of the rollers altogether. This circumstance would render the plan inapplicable to ship timber and to many other purposes; neither could trennels be prepared for the rollers as proposed by the patentee, as they never are made of sawed stuff, but always of that which is split, as the former would be always more or less cut through the grain. Perhaps, however, the method proposed of forcing them through conical holes in steel plates may be found serviceable.

Patent granted to WILLIAM HALLEY, *of Holland-street, Blackfriars-road, Surrey, iron founder and blowing machine maker, for improvements in the construction of forges and bellows.* Dated March 5, 1825.

THE forge of the patentee is designed to be portable; and its hearth forms the bottom of an iron box, which has fixed ends and back, and opens at one side. It has also a lid, whose hinges are placed above the twyre, which, when the forge is in use, can be raised vertically, and secured in that position by two bolts; but can be shut down and fastened by a hasp and padlock when the forge is to be laid by, and thus the whole forms a safe receptacle both for the tools and the moveable stand, on which it is to be placed when wanted, and which is contrived so as to be easily taken to pieces, and stowed within it. The four legs of this stand pass through four holes at the angles of a square iron frame, which they support at about a third of their length from the ground. The tops of these legs are made a little conical, and on these parts another square frame, of slighter composition than the lower one, fits down in a similar manner; and above this last frame the hearth is placed; through holes, in the angles of which the conical tops of the legs pass, and by their close fitting there, and in the two frames, make altogether a steady support for the forge; the back of which, about the twyre, and the part where the coals lie, are made of cast iron, of considerable thickness, while the rest is made as light as durability will permit.

The bellows, which form another of the articles intended to be secured by this patent, are made square, like an organ bellows, that they may contain, in the space which they occupy, more air than those with an angular or pyramidical termination.

They are likewise formed with a plate-iron top and bottom, the weight of which acts in general sufficiently in working them, without its being necessary to use the weights usually appended to common bellows. To the edges of these iron plates, wooden frames are fastened by screws, and to these wooden frames the leathers of the bellows are nailed in the usual manner. These bellows are placed directly beneath the hearth of the forge, and are supported near the larger end by two gudgeons, that rest within hooks, prepared for them on the top of the lower iron frame, while the smaller extremity is fixed on the end of the same frame, that lies beneath the twyre; and from this last-mentioned part of them a pipe ascends and enters the twyre, through which pipe, of course, the wind is to pass when the bellows are worked, which operation is performed by an iron piece, shaped so as to form three sides of a square, whose two extremities are jointed to the lower square iron frame, while its third side hangs down below the bellows. From the middle of this lower side a piece projects at right angles, at the side opposite to the twyre, whose end is made forked, to hold a roller or pulley; and a handle being fastened into a socket at the joint of this apparatus, and rising obliquely upwards towards the tyre end of the forge, it follows that when this handle is moved to and fro, the pulley will be alternately pressed up against the bottom of the bellows, and withdrawn again downwards, by which means the bellows will receive the motion necessary for their action.

Besides this there is a sliding bar placed across at the upper square iron frame, that rests on the tops of the legs, by which the bellows are sustained up out of the way when required, which fits them better for ship use, especially at the times when the decks are scrubbed and washed.

This forge seems well calculated for the situation last-mentioned, as it is a considerable object on board ship to have every thing contrived so as to be stowed away in as little space as possible; and a forge is a very necessary appendage to a ship, particularly where long voyages are designed, when accidents may always be more or less expected, for the repair of which a forge would be indispensable. We suppose the patentee intended his forge entirely for this use, as it appears to us that the common portable forge on wheels, used in our military service, is preferable to it for locomotion on land.

The patentee, in his description of the stand for the forge, gives the two square iron frames that connect it together the appellation of *rings*, which perversion of language causes a difficulty in understanding the specification that deserves to be noticed, as the distinction between round and square is such as cannot be expected to be confounded, and therefore is the more puzzling when they are thus used as synonymous terms in a document, where precision is so highly necessary.

Patent granted to John Heathcoat, *of Tiverton, Lace-manufacturer, for an improved economical method of arranging machinery used in the manufacture of lace, and in that used in weaving and in spinning by power.* Dated 9th March, 1824.

The specification of this patent relates to the buildings for containing the machinery mentioned in the title, more than to the machinery itself, and of this, its frame-work alone is brought into use on this occasion.

The machines for making bobbin-net lace by mill work have the sides of their frames four or five feet high, and some new ones designed have them much higher. One chief object of the plan for which this patent was obtained, is to make these sides an efficient part of the building for containing the machines, by converting them, by a small addition, into so many pillars, for supporting the floors, to which purpose the frames of power-looms, and those of the machinery used in spinning cotton, wool, and flax, are applicable also, and perhaps those used in other manufactures.

The advantage of this is evident in the saving of expence of the cost of so many tons of iron, which a building so arranged would require less than one where the pillars to support the floors were of this metal, and detached, as usual, from the machines.

To put this plan into execution, it is proposed, after forming the sides of the machines to act as pillars, to arrange them so on the ground floor—for example, that two rows of machines, with an alley between them, will occupy the space intended for the building. The addition necessary to the sides of the frame for this purpose will be, besides some addition to their length, flanches cast to them at top and bottom, at least at two sides, in the direction of the length and breadth of the mill, to tie them by bolts firmly to the beams, so as to prevent the entire combination, thus formed, from yielding either to a lateral or longitudinal thrust. A proper foundation having been, of course, first prepared for those pillars of double use, (either by iron frames or other substantial materials,) when they are placed on it as mentioned, the beams for the next floor, which are directed to be of iron also, are then to be fastened by screw-bolts above the upper flanches of the pillars, and to have proper longitudinal bars fixed between or over them, so as to brace the floor firmly in that direction, in the same way as the beams secure it from side to side. On these beams and braces the first floor is to be laid, which, to correspond with the rest of the building, should be a combination of iron frames, with tiles or bricks, so as to be fire-proof. Over this floor, and directly over the lower pillars, another set are to be erected, in the same manner, to sustain the second floor, whose lower flanches, by this position, can be fastened to the beams by the same set of screw-bolts which unite to them the upper flanches of the lower pillars.

The second floor being formed as the first, a third set of pillars may be erected above it, in the same way, to support a third floor, and so on, successively, as many floors as are desired may be formed.

The principal frame work of the machinery, and the floors being thus erected, will be altogether independent of the walls, which the patentee directs to be built outside the whole, and independent of the floors, and so as only to assist in supporting the roof.

But to further economize, where extensive works of this nature are required, the patentee directs that the building or framing described shall be arranged in the external sides of a hollow square, having only walls of masonry externally, and entirely open to the inside area, in which way the floors will somewhat resemble the galleries of a play-house. The area in the middle is to be covered in above with a roof, having numerous or extensive sky-lights, to give light to the work-people at that side, while large windows in the external walls illuminate the building fully from the outside.

This last part of the plan, besides the saving of the expence of nearly half the walls usually employed for such buildings, for the much less cost of the additional roof, will also give great facilities to economize both in the warming and lighting the factory so formed, and will moreover render the inspection of the work-people more easy, and capable of being performed by fewer persons; for which latter design the patentee proposes to erect a building in the centre of the square, high enough for the purpose, from whence the overseers may observe every part of the works.

Besides the advantage of economy mentioned, this method of building will give greater firmness to the fabric, and make the whole frame more inflexible, so as to better resist the vibrations and concussions of the mill work, which are found to be very prejudicial to the operations of delicate mechanism.

The patentee does not confine himself to a quadrangular form for these buildings, but claims the use of any other right-lined polygonal figure also for this purpose, and only excludes those with curved sides, as right-lined figures are necessary in the shape of the floors, for the more perfect and economical arrangement of the frames of the machinery, so as to produce the best support of the floors, and the greatest stability for the fabric.

An arrangement of building, very similar to that above described, was proposed a few years since by Mr. Jeremy Bentham, to be used in the construction of prisons, and, as well as we can recollect, particularly for the Penitentiary at Millbank; but the patentee is the first, we believe, who has thought of applying the principle to factories, for which it would no doubt be well adapted, when they were sufficiently extensive; we mean merely as regards the form of the building, for the other parts of the plan are no doubt applicable to factories of all sizes.

We much doubt whether the mode of inspection proposed would be found adequate, particularly in a very large building, as it would be hardly possible to erect a central tower, so as to command the view of every part of it; to say nothing of the necessity of the inspector's passing in person to the place where he saw any thing amiss, which is not provided for by the patentee, though Mr. Bentham has well attended to arrangements for this purpose in his plan, which the circular shape of his building (that would not suit a lace mill, for the cause before stated,) much facilitated, as well as its size being upon a scale that would not answer for a factory.

There is one advantage of this mode of erecting a factory, which the patentee does not mention, and which would also assist in making it come cheaper than the common mode, which is, that in the latter the space between the floors, or the height of the rooms, must be considerable, to enable the work-people to have sufficient air for health, or to endure the smoke of the numerous lights necessary for such factories in winter; but in the method proposed by the patentee, the floors need not be more than seven feet apart, as the internal space above the central area will, in this case, yield abundant supply of air, and carry off the smoke of lamps, candles, or gas-lights, most effectually.

We doubt much whether external walls could be built to stand long, of the height usual for factories of the description mentioned, without having any ties or beams to connect them, or assist in withstanding the impulse of the elements as proposed by the patentee, as he expressly directs that the beams of the building are to be sustained alone by the internal framing, and have no connexion with the walls. But though experienced builders would not be easily induced to raise lofty walls in this manner, this defect in the plan is easily obviated, as the mode of erecting the internal framing gives facilities for forming cheap external fences against the weather, of various kinds; for example, a little addition to the iron framing proposed would form a sufficient support for the materials for this purpose, instead of requiring any from them; and as in buildings of the nature proposed, large windows would be required, and of course the spaces between them would be proportionably narrow, supposing those windows placed between iron pillars, somewhat similar to the others, and to be connected in like manner with the beams, the intervals between them being thus formed into square iron frames, might be filled up with single brick walls, secured by thin iron cross ties; or iron frames might be fitted into them, similar to sash frames, in the squares of which slates might be fitted and fastened in a similar manner to panes of glass, but with some cement cheaper than putty; for which purpose Roman cement, as it is called, would answer very well; and if the inside of these frames were fitted up with slates likewise in the same manner, the air confined in the spaces between them and the external slates would form a sufficient barrier against changes of the atmosphere, to keep the building as warm as most walls would; since confined air is well known to be one of the best non-conductors of temperature.

Patent granted to the Rev. Moses Isaacs, *of Houndsditch, London, for improvements in machinery, which, when kept in motion by any suitable power or weight, is applicable to obviate concussion by means of preventing counteraction, and by which the friction is converted into a useful power for propelling carriages on land, vessels on water, and giving motion to machinery.* Dated Feb. 19, 1824.

The specification of this patent contains several different objects, some of which the Reverend Patentee has borrowed after the fashion of the Jews towards the Egyptians, and others by no means correspond to the intelligible part of the title.

The first of these, which comes under the first class, is a wheel with spring spokes, consisting of the fellies, rim, and nave, made as usual, but having arched spokes, formed of cane, steel plate, or any other elastic material, the inner extremities of which are confined between two hoops in the nave, while their other ends are let into the fellies.

To prevent a carriage being overthrown, the patentee directs an implement to be used, consisting of a metal tube, inclosing a rod having serrated teeth at its sides, which are acted on by a pair of spring nippers or catches. This is to be suspended in such a position from the upper part of the carriage, that when it inclines over above a certain degree, the rod will fall forward from the tube by its own weight; and being prevented from returning by the catches pressing on the serrated teeth, will act as a prop to prevent the carriage from any farther inclination, in the opinion of the Reverend Patentee.

The next article is a proposed arrangement of bevelled wheels and pinions, to transfer the friction of the axles, and make it *aid the propelling of the machinery.* Here lies the grand secret of the business, and that alone to which the title of the patent has any reference; but, unfortunately for the public, the Rev. Patentee has preferred to make his patent useless and untenable rather than communicate it; and actually gives no account whatever how said "bevelled wheels and pinions" are to be made to perform this miracle.

The third subject of the specification runs quite wide from the title, and is actually new. It is no less than a steam-engine, differing from all of that numerous race with which we are acquainted. It is to have three cylindrical boilers, ranged above a moveable furnace, the middle one of which lies higher than the other two, about the extent of its semi-diameter. It has also two working cylinders, one at each end of the beam, and two spring rods, for opening and shutting the valves, placed in a similar manner. The furnace or fire-place turns on two pivots, in the line of its longer axis, so as to incline at its upper part about 23 degrees with the horizon; and pipes passing from the boiler, most exposed to its heat by this position, to the working cylinder at the opposite side, elevates its piston, and forces thereby the other end of the beam to descend, which closes the valves of the steam pipe between that cylinder and the first boiler, by the spring rod at that side, and turns over the fire-place to the opposite boiler, which acts on the other cylinder in a similar manner; and so on alternately. But an extraordinary part of the contrivance still remains. Any one would suppose that the steam, after acting on the piston, would be either permitted to escape or to pass into a condenser. The patentee, however, has no idea of thus wasting this valuable agent, but directs that it is to pass off into the boiler next to it, which is the one from which the fire is turned off at its emission; and thus supposes that the difference of temperature caused in the boilers by the mere nutation of the fire-place in the small degree mentioned, will be sufficient to produce a change of pressure on the opposite pistons, powerful enough to work the engine effectually.

Any thing new relative to our potent auxiliary, the steam-engine, deserves some attention; and the idea of operating, by causing a change of temperature in two boilers acting on the same engine, is certainly of this description: but we have good reason to suppose that for the common rate of working, this change could not be effected sufficiently speedy by any means of withdrawing or screening the fire from the boilers. If engines could be applied to any useful purpose, which would make an alternation of the piston only once in ten or twelve minutes, perhaps the patentee's plan might be made to act, but by no means in the economical mode he thinks; for in this way he loses the heat of his steam through the sides of the boiler, which is the valuable part of the steam (and, in fact, it is by the alternation of this loss in the two boilers that his engine could work at all), and only saves the water, which, except for locomotive engines, is of no value, and for them only as its expenditure makes a greater weight necessary to be carried.

Of the prop to prevent carriages being overthrown, we will only observe, that as soon as it touched the ground it would be either broken or tumbled over by the progressive motion of the carriage, there being nothing attached to it to prevent this effect.

Of the bevelled wheel and pinion apparatus we will reserve our opinion till the patentee pleases to explain to the public how they are to perform the purpose for which he designs them, and thus fulfil the proviso of his patent, which relates only to this part of his specification, as its title will abundantly prove.

Lastly, of the wheels with spring spokes we must observe, that the Reverend Patentee has not only borrowed the invention, but part of the description of it given by the real inventor.

In Vol. XVII. of the second series of the Repertory of Arts, &c. there are some observations on wheel carriages, roads, and the draft of horses, communicated by Mr. J. W. Boswell to a Committee of the House of Commons, appointed to take these subjects into consideration, which, with several other similar papers, were ordered to be printed by the House, in 1809. In the plate accompanying these observations will be found a figure of this very wheel with spring spokes, and in the description of it the very same directions for fastening one end of each of the spokes to the nave by two hoops, and their other ends to the fellies, that Mr. Isaacs gives; and also the following account of the advantages of this species of wheel, great part of which the Rev. Gentleman has copied into his specification. In the third paragraph of the section on the spring wheel, in Mr. Boswell's paper, it is stated that "the spring wheel would possess the very singular property of preventing all loss of momentum from common obstacles and ruts; for when the rim struck an obstacle, the re-action, instead of destroying part of the momentum of the carriage, would only cause the spring spokes to bend towards it; and when the axle was past the obstacle, the recoil of this bending, which would then take place, would add as much to the velocity of the carriage as the bending before took from it."

This gross plagiarism, to say no worse of it, is not very creditable to the Rev. Patentee, and certainly would merit more reprehension if the very act did not bring its punishment along with it, by rendering his patent untenable. Indeed it is very doubtful, even without this, if a patent, where a specification differs so widely as Mr. Isaacs' does from the title of the patent, and containing matter so totally unconnected with it, could be sustained in a court of law; the title of a patent, and the exact accordance of the specification to it, being points of very great importance to its validity.

Patent granted to Henry R. Palmer, *of Hackney, Middlesex, Engineer; for improvements in the construction of rail-ways and tram-roads, and of the carriages to be used on them.* Dated November 22, 1821.

Mr. Palmer's rail-way differs from those in common use, in consisting of one rail only, elevated on posts, some height above the ground. On this rail carriages of a peculiar construction are to be moved without upsetting, by having the centre of gravity of their loading suspended below the line of support, or rail. They are to have but two wheels, placed 3 or 4 feet apart on the rail, whose axles are to support a light iron frame, from which the loading is to be suspended in two cases or packages, one at each side of the rail, in such a manner, that if a little more weight should be in one than in the other, it may not materially impede the progress of the carriage; and they are drawn forward by the horses, with ropes of 20 or 30 feet in length, as boats are on canals. The posts, when made of cast iron, are to be constructed in the form of two planes, crossing at right angles, similar to the pillars of some of the gas-lamps, with a projecting horizontal flanch in the middle of their length, and tapering somewhat in both directions from thence; this flanch is to lie at the surface of the ground, when the post is fixed in its place, all below it being buried in the earth; at the top of each post a slit, or fork with parallel sides, is formed in the direction of the rails, the extremities of two pieces of which rest within it, they being formed with vertical scarfed joints there for that purpose, and having beneath them wedges placed, by driving which the level of these rails can be adjusted more exactly. When the pieces of the rail exceed a certain length, they pass through the tops of more of the posts, but in all cases are placed there as described. To fix the posts firmly in the ground, a hole is dug, of a proper depth, depending on the nature of the soil, and its bottom rammed firm with a conical rammer, by an engine like a small piling engine; some broken stones, such as are used for making roads, are then thrown in, and rammed, up to the place intended for the bottom of the post, which is then put into the hole, and more of the broken stones thrown in, and rammed tightly about its sides, which are cast of a serrated or notched shape, the better to adhere to the stones; and this process is continued till the hole is filled up. The posts must vary in height, according to the undulations of the ground, and their distances must depend on the thickness of the rails, though the patentee seems to prefer distances of ten feet.

Mr. Palmer asserts that this arrangement of the rail will cause a great saving in embankments, bridges, culverts, and drains, and that the carriages will be moved on it with less friction and resistance than on the rail-ways hitherto in use; averring that a horse can draw a load on it, when level, of 33,750 lbs. 2½ miles in an hour, which on the best performing edge rail-way that he had heard of (that near Newcastle-on-Tyne) could move only 17,773 lbs. at the same rate.

We should be greatly at loss to account for the superiority of performance just mentioned of Mr. Palmer's rail-way, and even to suspect exaggeration, could we not see in the nice adjustment of Mr. Palmer's apparatus, and in his curious contrivance to lessen the friction of his wheels, (which we are, by the by, inclined to attribute to its bringing a larger surface of the axle and hollow box of the nave into contact, instead of the oil being prevented by it from assuming the shape of a wedge, as Mr. Palmer asserts,) somewhat to justify the validity of the experiment; to this we have to add, that the shape of the surface of this rail, which is the segment of a circle, and the hollow rim of the wheel being also of the same circular form, will at *first* give a great superiority to the performance of the apparatus, which the power of adjusting the level, or inclination of the rail by the wedges, to unusual nicety, must greatly assist. But as all these circumstances are equally applicable to the common double rail-roads of the edge form, we think that farther trials than those made previous to the publication of his book will be necessary, impartially conducted, with wheels, axles, and both parts of the ap-

[illegible] equally good and perfect in the other species of rail-roads, before the question can be fairly decided.

That the form of the surface of the rail and rim of the wheels, being segments of circles, will at *first* much facilitate the draft, as we have just stated, depends upon the well-known geometrical problem, that a circle described within another circle can only touch it in a point; therefore as long as these forms continue perfect, the lateral friction of the projecting part of the rim of the wheel against the side of the rail will be avoided, and so long will a great source of resistance, which is experienced in other rail-roads, be overcome.

The Penrhyn rail-way, which was originally formed in this manner, had at *first* all the advantages stated; but according to the authority of Mr. Benjamin Wyatt (for which see Repertory of Arts, second series, Vol. III. p. 285) the two circular surfaces of the rail, and of the wheel's rim, as they wore, excavated the latter so much, and caused it to fit so tight, as to occasion much friction, and make it necessary to change the wheels so often, that another form of rail and wheel became necessary; from which it follows, that time is needful in experiments of this sort as much as any thing else, and that it is requisite new kinds of rail-ways should be in perfect operation for a reasonable period, before their superiority can be allowed.

We consider Mr. Palmer's rail-way to be a very ingenious invention, and think his publication on the subject contains much useful information on rail-ways in general, though we cannot agree with him in his statements of its advantages. A rail-way of Mr. Palmer's construction has been erected at Cheshunt, near Waltham, to carry bricks from Mr. Gibbs's fields, about a mile, to the river Lea; it is constructed of wood, with posts about five feet high, and ten feet apart, as we are informed, and has the surface of the rail covered with an iron plate. Nothing at present can be learned from this experiment, but that the plan is feasible, which we never doubted; but for the reasons stated we must wait for the effects of wear, and of the weather upon it, before we can decide how far the posts will maintain their upright position, and the rails their level, the first of which points we do not think sufficiently provided for by the patentee. In point of expence, a wooden rail can be no guide for those to be made of iron; and when formed of this latter material, we think the patentee deceives himself in supposing that his rail-way can be made cheaper than a common double one; for, supposing his made with rails of the same strength as they are, and of course requiring supports, as they do, at every three feet, or thereabouts, now his pillars being three feet at least above ground, and as much more below the earth, (according to his drawings) and requiring to be of considerably greater substance, it is evident that they will take at least double the weight of iron for their construction, which would be necessary for the second rail, saved by his plan; and if, as he proposes, they be set farther asunder, nothing will be gained in this respect, since the rails then must be made so much stronger in proportion; (to which must be added, that they must in all cases be made of double the strength of common rails, one of them having to sustain the load of two of these;) and as for the lengths of ten feet between the posts suggested, their weight, to carry the usual loads, must be so much greater than that of any now used, that we much doubt if any of them, of iron solely, will ever be constructed.

That erecting numerous lofty pillars of iron, as proposed by the patentee, can cost less than embankments of earth, (in general the cheapest mode known of raising an elevated surface), we cannot in any respect credit, and can still less give faith to, the advantage of making rail-ways of this kind ten feet high above the level of the earth, advocated by some of his friends.

We have further to remark, that loads carried as designed on this rail-way will, from their pendulous arrangement, be extremely liable to be knocked against the posts in high winds, to the great damage of the goods carried, as well as the obstruction of their conveyance, which, in case of a storm, blowing across the rail, may be sometimes so great, as to render the rail-way totally impassable for the time of its duration.

The injury from unequal loads at the two sides of the carriages, we do not think would be found so slight as asserted by the patentee, who states that all acquainted with *geometry* must be of his opinion on this point. Now in the first place, it remains with him to show what problem of geometry can be brought to bear on the question, and that he has not used the word geometry here in the vulgar sense for equilibrium; and, in the next place, to point out how he prevents the danger incurred by the oblique position of the wheels, which this must occasion, of the carriage being entirely dismounted. The rods, which connect the loads with the axles, being jointed to them so as to be at right angles to them in all their oscillations, (which we suppose is what is meant by their being *inflexible*,) though it will, when the centre of gravity of the load is placed below the rail, keep them from tumbling off directly, yet will not prevent the risk of the accident mentioned, while it will increase that of their being knocked against the posts.

In conclusion, were we obliged to decide on the question in the present stage of this experiment, which, however, we do not wish to do, we would say that the plan of single rail-ways should be confined to that species of them constructed at Cheshunt, as they would be much too costly if formed of iron, for the reasons before stated. The great defect of the wooden framing would be its want of durability, and the expence of its repairs, particularly in the posts, which would be extremely liable to rot at the level of the ground; for which, in order to show that we have no ill will to the plan, from being able to see its defects, we will point out a remedy, which will make them more durable, and facilitate the repairs—which is, to have square cast iron sockets, two or three feet long, placed so as to occupy this portion of them, let down firmly for half their length, on the lower part of the posts, secured in the earth as before described, and the other half forming a receptacle for the bottom of the upper portion, which should be formed so as to project a little beyond it at every side, to throw off the rain; and in order that the fitting between the wood and iron socket might be more perfectly tight, the wood in this part should be previously impressed by screws, a method already practised to great benefit in the preparation of staves for casks; to facilitate which process we have advised the sockets to be made square, instead of cylindrical, a form which, in other respects, might at first appear more adviseable.

LIST OF NEW PATENTS.

Jean Jacques Saintmarc, of Belmont Distillery, Vauxhall, Surrey, distiller, for improvements in the process of, and apparatus for, distilling.—Dated June 28, 1825.—Six months to enrol specification.

David Redmund, of Agnes Circus, Old Street Road, Middlesex, engineer, for improvements in building or constructing ships, houses, and other buildings.—Dated June 28, 1825.—Six months to enrol specification.

George Tompson, of Wolverhampton, Gent. for an improvement in the construction of riding saddles.—Dated June 28, 1825.—Six months to enrol specification.

John Heathcoat, of Tiverton, lace-manufacturer, for improvements in the method of manufacturing of thrown silk. Dated July 6, 1825.—Six months to enrol specification.

William Heycock, of Leeds, woollen cloth manufacturer, for improvements in machinery for dressing and finishing of cloth.—Dated July 8, 1825.—Six months to enrol specification.

John Biddle, of Donnington, in the county of Salop, glass-manufacturer, for a machine or combination of machinery for making, repairing, and cleansing roads and paths, which machinery, or parts of which machinery, is or are applicable to these and other useful purposes.—Dated July 8, 1825.—Six months to enrol specification.

Molyneux Shuldham, of Brampton Hall, Wrangford, Suffolk, Lieutenant in the Navy, for improvements for the purposes of setting, working, reefing, and furling the sails of boats, ships, and other vessels.—Dated July 8, 1825.—Two months to enrol specification.

William Furnival and John Craig, both of Anderton, Chester, salt-manufacturers, for improvements in the manufacturing of salt.—Dated July 8, 1825.—Six months to enrol specification.

John Day, of Nottingham, and Samuel Hall, of the same place, lace-manufacturers, for an improvement on a pusher twist or bobbin-net machine.—Dated July 8, 1825. Two months to enrol specification.

Walter Hancock, of King-street, Northampton-square, Middlesex, jeweller, for an improvement or improvements in the making or constructing of pipes or tubes for the passage or conveyance of fluids.—Dated July 16, 1825.—Six months to enrol specification.

William Hirst and Henry Hirst, of Leeds, manufacturers, for improvements in the art of scribbling and carding sheep's wool.—Dated July 16, 1825.—Six months to enrol specification.

Henry Hirst, manufacturer, and George Bradley, machine-maker, both of Leeds, for improvements in the construction of looms for weaving woollen cloths.—Dated July 16, 1825.—Six months to enrol specification.

Thomas Wolrich Stansfeld, merchant; William Prochard, civil engineer; and Samuel Wilkinson, merchant, all of Leeds, for improvements in looms, and in the implements connected therewith.—Dated July 16, 1825.—Six months to enrol specification.

Thomas Mussehohite, of Devizes, saddler, for improvements in the manufacture or construction of collars for horses or other animals.—Dated July 16, 1825.—Two months to enrol specification.

Marc Isambard Brunel, of Bridge-street, Blackfriars, London, Esq. for certain mechanical arrangements for obtaining powers from certain fluids, and for applying the same to various useful purposes.—Dated July 16, 1825. Six months to enrol specification.

Thomas Sitlinton, of Stanley Mills, Gloucestershire, engineer, for improvements in machinery for shearing or cropping woollen or other cloths.—Dated July 16, 1825. Six months to enrol specification.

Joseph Farey, of Lincoln's Inn Fields, Middlesex, civil engineer, for an improvement in lamps.—Dated July 16, 1825.—Six months to enrol specification.

Thomas Robinson Williams, of New Norfolk-street, Strand, Middlesex, Gent. for an improved lancet.—Dated July 16, 1825.—Six months to enrol specification.

Thomas Cook, of Upper Sussex Place, Kent Road, Surrey, Lieutenant in the Navy, for improvements in the construction of carriages, and on harness to be used therewith; whereby greater safety to the persons riding in such carriages, and other advantages, will be obtained.—Dated July 16, 1825.—Six months to enrol specification.

Joseph Cheesebrough, of Manchester, merchant, for a method of conducting to and winding upon spools or bobbins, rovings of cotton, flax, wool, or other fibrous substances. Communicated by a foreigner.—Dated July 16, 1825.—Six months to enrol specification.

William Hirst, Gent. and Joseph Carter, cotton spinner, both of Leeds, for an apparatus for giving a new motion to mules and billies.—Dated July 16, 1825.—Six months to enrol specification.

John Palmer de la Fons, of George-street, Hanover square, dentist, for an improvement for extracting, and method of fixing, teeth.—Dated July 16, 1825.—Six months to enrol specification.

Jonathan Downton, of Blackwall, Middlesex, shipwright, for improvements on machines or pumps.—Dated July 19, 1825.—Six months to enrol specification.

THE REPERTORY OF PATENT INVENTIONS, &c.

No. III. SEPTEMBER, 1825.

Specification of the Patent granted to JOSEPH SPENCER, *of Belpar, Derbyshire, Nail-manufacturer, for certain improvements in the construction of furnaces or forges for the preparation of iron or steel, and for the process of manufacturing of nails and other articles from the said materials.* Dated April 7, 1824.

TO all to whom these presents shall come, &c. *Now know ye*, that in compliance with the said proviso, I, the said Joseph Spencer, do hereby declare that the nature of my said invention, and the manner in which the same is to be performed, are particularly described and ascertained by the following description thereof, (that is to say):—The furnace or forge which I have used for the making of nails (which is also calculated for other small articles), is an elevation of brick-work of a circular form, four feet in diameter, and three feet in height, having a circular opening for the fire in the centre, and communicating on the ground with the outside by an aperture, for the purpose of removing the dust and dirt that may fall through the grate.

When the brick-work is carried up 20 or 24 inches, the circular opening in the inside is to be covered with a very fine grating of cast iron, the bars being only a quarter of an inch apart, and the grating of sufficient dimensions to form a bottom to the fire-place. The brick-work is then to be raised three courses, using either common or fire bricks round the internal opening, inserting the tue iron for the bellows, and leaving an aperture for the bellows pipe. The whole is then covered with a flat circular cast iron plate, in one, two, or more pieces, having a rim round the external edge, to the depth of six inches, to hold the fuel for the occasional supply of the fire. This plate has an opening in the centre, sufficiently large to take a frame which is placed immediately upon the fire bricks, which frame consists of a ring of cast iron, flat upon the bottom, one and a half inch thick on the outside edge, and bevelled to the thickness of half an inch upon the inner edge. The external diameter of the ring is 20 inches, and the opening of the inside 14 inches. To this ring are fixed, in a triangular position, three pillars, nine inches high, to support another ring, of the same dimensions and material as the ring above described, about half an inch in thickness, with a small rim or selvage on the outer edge, to admit of the brick work of the chimney being placed within it. The brick-work of the flue of the chimney is then carried from this upper plate or ring to the height required. There are also inserted in the brick-work three troughs of cast iron, for the purpose of holding water.

The bellows are suspended upon a frame, in the situation that may be most convenient, and are worked by a double lever united with a bow, and passing round the chimney so as to be within reach of every one of the workmen who may be employed round the furnace; and in the making of nails six workmen may be very advantageously employed at the same time, who will keep up a continual blast from the bellows, so that the fire will be at all times in a bright and vivid state.

Now though I have adopted a circular form and brick-work in the forge or furnace described, I do not confine myself to the circular form, or limit myself to the dimensions here given, as any other form or size may be used, better suited to the size and shape of the article to be manufactured. Also stone may be used in the elevation, or it may be made altogether of iron, or partly of iron, stone, or brick-work.

In the preparation of iron, or steel, for the purposes of manufacturing nails or other articles, I use a certain portion of coal, purified as far as possible by calcination from sulphur or other noxious matter, and a certain portion of wood charcoal. The proportions I have adopted are, one-fourth part by measure of wood charcoal, and three-fourths of prepared or purified coal; but these proportions may be varied according to the nature of the coal, and the metal to be wrought.

In witness whereof, &c.

OBSERVATIONS BY THE PATENTEE.

There are many novel features in this invention which do not, on the perusal of the specification, strike the reader. Nothing is represented to his mind but bricks, mortar, and iron, in the form of a forge, with which substances forges have been erected since the days of Zubal, while, to the operative man, who has to preserve the quality of pure iron uninjured, this invention presents a most invaluable acquisition. In no other forge (excepting a hollow fire) can pure wood charcoal be used; no other forge is constructed without a back; no other forge has a grating to keep the fire clean, and prevent the accumulation of clinker; no other forge will admit of the same number of workmen being employed at the same time; no other forge can be erected at so little expence.

Specification of the Patent granted to JACOB PERKINS, *of Fleet-street, London, Engineer, for improvements in the mode of heating, boiling, or evaporating by steam, of fluids, in pans, boilers, or other vessels.* Dated May 17, 1823.

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WITH AN ENGRAVING.

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TO all to whom these presents shall come, &c. &c. *Now know ye*, that in compliance with the said proviso, I, the said Jacob Perkins, do hereby declare the nature of my said invention by the following statement thereof, that is to say:—Whereas I, the said Jacob Perkins have heretofore obtained His present Majesty's letters patent under the Great Seal of Great Britain, bearing date at Westminster, the 10th day of December, in the third year of His reign, for certain improvements in steam-engines. (Published in our 43d vol.) And whereas a specification of the said patent was enrolled on the 10th day of June, 1823, in the proper office for that purpose; and whereas the said specification did contain a description of a generator, such as is hereinafter alluded to. Now the nature of my said invention doth consist in pipes, hollow cylinders, or other the like apparatus, projected from such generator as aforesaid, into fluids, which apparatus is to be filled with steam from such generator as aforesaid; for the purposes of heating, boiling, or evaporating the said fluids in pans, boilers, or other the like vessels; and which apparatus is to be so arranged with valves and a forcing pump, as to return the water produced by the condensation of the said steam into such generator as aforesaid; and which apparatus is to be so arranged also, that the said steam and water is always under mechanical pressure. And in further pursuance of the said proviso, I do hereby describe a manner in which my said invention may be performed, by the following description thereof, reference being had to the drawings and figures annexed, that is to say:—

DESCRIPTION OF THE DRAWING. (See Pl. VI.)

Fig. 1 is a sectional elevation of an apparatus on the principles of my said invention: A is the generator described in the specification of my said patent for certain improvements in steam engines: B is a forcing pump: C C C is a pipe or hollow cylinder, opening to and projected from the upper part of the generator at D, and opening to and projected from the lower part of it opposite the part marked E, which will be more clearly shown when describing the next figure: F is a pipe leading from the pipe, C, to the forcing pump: G is a valve, and H is a boiler, pan, or other vessel, supposed to contain fluid. In this application of the generator, J acts only as a safety valve. Fig. 2 is a plan of the apparatus described in fig. 1, and shows more clearly the particular process that is effected by it. The parts in this figure which are similar to those in fig. 1 are marked with the same letters: K is a valve not shown in fig. 1, and L is the particular part of the generator at which the end of the pipe, C, hereinbefore described as being opposite the part marked E, opens into the generator. It will be seen by this arrangement, that steam being received into the pipe, C, from the generator, at D, it passes into that part of the pipe which is projected into the vessel, H, containing the fluid to be heated, there the steam becomes condensed, and collects in the form of water at the neck of the valve, G. When the handle of the forcing pump is raised, the valve, G, opens, and the water fills the remainder of the pipe, C, and the pipe marked F, the valve, K, remaining shut. When the handle of the forcing pump is pressed down, the valve, G, shuts, and the water being thus prevented from returning into that part of the pipe, C, which is in the fluid, forces open the valve, K, and finds its way into the generator again at L. Now whereas the exact dimensions and proportions of my said invention are not material, but those represented in the drawing annexed are what I consider the best, as far as regards the parts immediately connected with the generator, for those parts which are introduced into the fluids which are to be heated by them, must be varied both in size and shape, according to the various situations in which they are to be applied. And whereas I have herein described a generator for the purpose of elucidating, but which forms no part of my present invention; but such an apparatus as hereinbefore described, for heating, boiling, or evaporating by steam, fluids in pans, boilers, or other vessels, which said apparatus doth consist, as far as I claim any novelty therein, of pipes, valves, and a forcing pump, arranged as aforesaid, being, to the best of my knowledge and belief, entirely new, and never before practised in these kingdoms, I do hereby declare this to be my specification of the same, and that I do verily believe this said specification in all respects, fully, and without reserve or disguise, doth comply with the proviso in the said hereinbefore in part recited letters patent of the seventeenth day of May, contained. And lastly, I do hereby claim to maintain an exclusive right and privilege to my said invention.

In witness whereof, &c.

Specification of the Patent granted to HUMPHRY JEFFREYS, *of the city of Bristol, Merchant, for an improved flue or chimney for furnaces and other purposes.* Dated October 7, 1824.

WITH AN ENGRAVING.

TO all to whom these presents shall come, &c. &c. *Now know ye,* that in compliance with the said proviso, I, the said Humphry Jeffreys, do hereby declare the nature of my said invention to consist in a flue or chimney, so constructed as to cause an artificial draught in the same, and to condense the smoke and other matters evolved in such manner as to prevent their escape into the atmosphere. And in further compliance with the said proviso, I, the said Humphry Jeffreys, do hereby describe the manner in which I perform my said invention, by the following description thereof, reference being had to the drawing annexed, and the figures or letters marked thereon, that is to say:—

DESCRIPTION OF THE DRAWING. (See Pl. VI.)

The figure 3 in the drawing represents a section of one of my said improved flues: B represents the commencement of an ordinary flue, proceeding from any common furnace, the top of which is closed at C, sufficiently air tight to prevent the escape of any smoke. This part of the flue I shall call, by way of distinction, the smoke passage: E is a second passage or shaft, which I call the condensing shaft, and may be built either beside the smoke passage; the central partition wall being common to both, or at any convenient distance from it, provided always that the aperture of this shaft be perpendicular in its whole length. At the top of the condensing shaft, E, is a cistern, F, which must receive a constant supply of water from some convenient source. The bottom of this cistern must be perforated with small holes, so as to create an artificial shower when supplied with water; and the said supply of water must of course be regulated so as to meet the waste occasioned by the said holes. At the bottom of the shaft, E, is an opening or passage, G, by or through which the fallen water, condensed smoke, and all other matters which have descended, pass into a tank or drain, as the case may be, for the purpose of conveying the same to any considerable distance. In this figure or drawing the condensing shaft is represented as separated from the smoke passage, and D represents a communication passage, leading from the top of the smoke passage to the top of the condensing shaft, into which it should enter just under the cistern, F. This communication passage should in all cases be of as large dimensions as the smoke passage. It should here be observed, that when the smoke passage and the condensing shaft have one common wall to divide them, an aperture in the said wall, corresponding to that at H, in the drawing annexed, will suffice, without any communication passage. Now by the foregoing arrangement of flue or chimney it will be seen, that if smoke rise from the furnace into the smoke passage, and thence proceed into the condensing shaft, and if water be admitted into the cistern, and suffered to pass through the said holes in the bottom of the said cistern, down the condensing shaft, a draught will be occasioned that will draw the smoke and other matter evolved from the furnace, from the smoke passage into the condensing shaft, where it will be condensed and carried down with the falling water into the tank or drain below, as hereinbefore described; and such an arrangement of flue or chimney, for the purposes aforesaid, and effecting the draught and condensation aforesaid, in manner aforesaid, being, to the best of my knowledge and belief, entirely new, and never before used in these kingdoms. I do hereby declare this to be my specification of the same, and that I do verily believe this my said specification doth comply in all respects, fully, and without reserve or disguise, with the proviso in the said hereinbefore in part recited letters patent contained; wherefore I do hereby claim to maintain exclusive right and privilege to my said invention.

In witness whereof, &c.

OBSERVATIONS BY THE PATENTEE.

When the mode of condensation described in the foregoing specification first occurred to me, I had been looking into Bishop Watson's Chemical Essays, and was seeking a remedy for the various evils which result from the process of smelting ores, especially those of lead and copper.

It is well known what very pernicious effects are produced by the arsenical, sulphurous, and metallic vapours, which issue with the smoke from the furnaces constructed for the purpose in question, spreading their baneful influence to a very great distance. At Swansea, for instance, the face of the country, in a circuit of more than three

Fig. 1.

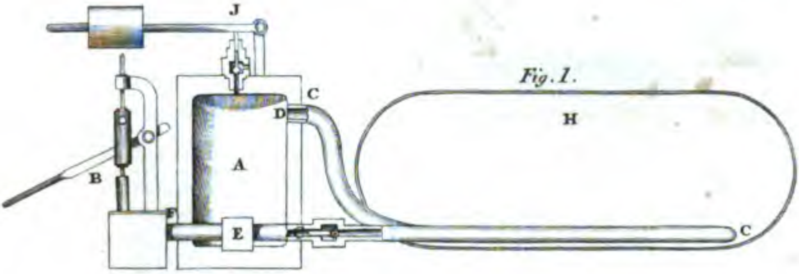


Fig. 2.

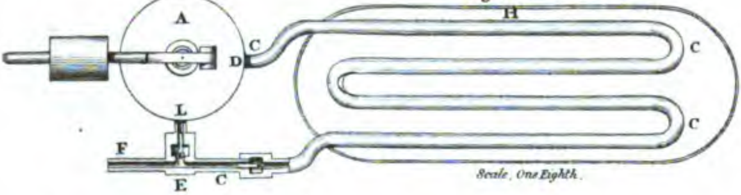


Fig. 3.

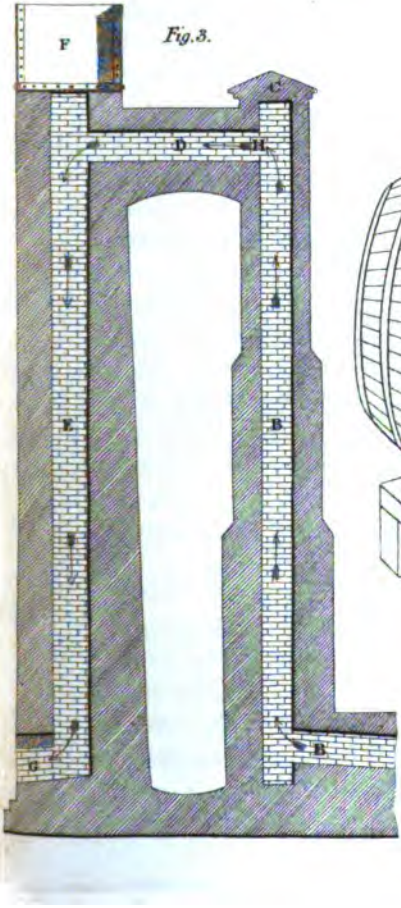
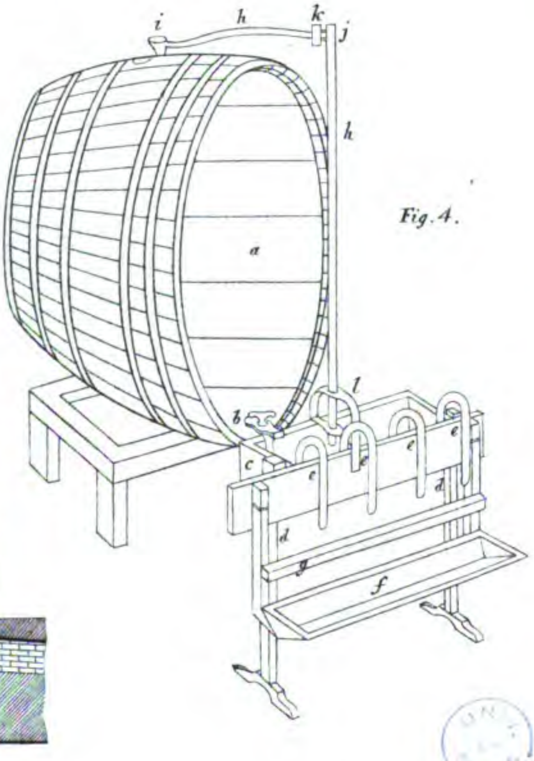


Fig. 4.



miles from the works, bears ample testimony of the deleterious effects, which cause disease, and often loss of life to the inhabitants and to cattle; vegetation being, at the same time, almost utterly destroyed.

The means by which I could thus effect condensation having presented themselves to my view, it became necessary that I should be circumspect when taking into consideration whether there were any and what obstacles to its being carried into active operation; but I have discovered none that are insurmountable. I admit, that in many cases the procuring the necessary supply of water may be attended with difficulty, as well as considerable and permanent expence; but these, of course, will vary according to local circumstances, and, in the most unfavourable, can bear no proportion to the advantages to be obtained. Will the preservation of life, whether of human beings or cattle, be of no estimation? Would no value attach to the bringing a wide district of sterile country into a state fit for cultivation? Are no profitable results to be derived from the condensation of all the sublimed metals, sulphur, and other valuable matters, which, by the old system, do so much incalculable mischief? I trust those whose interests are so deeply concerned, will not fail to give these questions their serious attention.

In the Chemical Essays I have alluded to, the Bishop says, it has been computed that 10,000 tons of lead ore are annually smelted in Derbyshire; and if means could be invented of saving the sulphur from this quantity of ore, which he considers to be equal to one-tenth of its weight (but he admits at the same time that it unquestionably yields more), Derbyshire alone would furnish 1000 tons of sulphur, which he values at 15,000*l.* Further on, he adds, "It is not easy to determine with precision the quantity of lead which is sublimed; a general guess, however, may throw some light on the subject. It is usual at a smelting-house to work off 60 cwt. of ore every 24 hours, which yields about 40 cwt. of lead; in addition to which, he calculates that 3 cwt. more is sublimed, which, *if it* *could be collected,* would make an annual saving at each smelting-house of above 50 tons."

In his eighth essay, Vol. III. he submits to the consideration of the lead smelters, whether they would not derive great advantage from substituting an horizontal chimney, of 2 or 300 yards in length, in place of the perpendicular one commonly in use. If he had been aware that horizontal chimnies might be extended to any distance without weakening the draught of the furnace, he certainly would not have failed to have recommended an improvement fraught with so many lucrative advantages. By the plan I offer, instead of lessening the draught, the means of increasing it, and of regulating it to any extent, and with the greatest precision, are obvious, and easily attained. If the chimney were a mile or more in length, horizontal, or tortuous, it matters not in what line of direction it may run, still the force of draught would be great as could be wished, provided that ultimately it be made to communicate with a condensing shaft, constructed in the manner I have described in my specification.

By this process, not only much valuable matter, but, literally, the whole, which by the old method is not only lost, but productive of such lamentable consequences, may, to a certainty, be preserved; for all the smoke, sublimed metal, and noxious vapours combined therewith, will either be deposited, as they part with their heat, in the great length of passage; or, if any portion of it when arrived at the extreme end should be still volatile, that also would be condensed and carried down by the shower of water.

Having asserted that the force of draught may be increased to any extent, it may be proper that I enter into some detail of the several causes which, both separately and collectively, tend to augment it; and I hope that in so doing I shall stand excused, since I do not expatiate on the subject with any expectation that I shall add to the stock of knowledge which others possess, but it is important to my object, that in taking a cursory view, as may probably happen, those points should not be overlooked which, on closer attention, would not fail to be duly appreciated.

It is well known that air and water powerfully attract each other, and in the specification it is stated that the shower of water which falls down the condensing shaft "must be constant." Being so, it must uninterruptedly carry down with it all the air it comes in contact with, and a vacuum would be left behind, were it not that other air rushes in to fill up the vacant space. But in what direction can it find admission, unless it be through the furnace?

There is another cause of draught, connected with the foregoing, which affords a material increase,—that air, which has passed through the furnace, and all the various matters which the fire has rendered volatile, have their volume expanded in proportion to the quantity of heat they contain. The bulk of this is again reduced when it is met by the shower of water, and again a vacancy would be created, were it not that it is instantly filled by the admission of atmospheric air, which, in like manner, must pass through the furnace.

There is a third cause of draught, which is, in my estimation, of most essential importance, particularly where a great force is required. All heavy bodies (and water is one) fall with a velocity which does not continue at one uniform speed, but which increases as the squares of the times taken up in their descent. For instance, a heavy body falls through a space of 16½ feet in the first second of time; but in two successive seconds it falls through a space of 66 feet, for the square of 2 is 4, and 16½ multiplied by 4, is equal to 66. Here then it is clearly shown that the means are in our power (and they are simple too) of raising the force of draught to an extent that appears to have no limits; for whether, on the one hand, the condensing shaft be increased in size, by enlarging its area, or otherwise by adding to its height, the desired object will be obtained; but where an intense rapidity of current may be required, the combination of increased area and height, with the shower of water duly proportioned to the purposes required, cannot fail to produce a draught that I am confident was never yet experienced from the operation of any air or blast furnace. It remains, however, to be proved how far this plan can be usefully applied to smelting of iron; but I trust it will not be long before a trial of it be made, since several scientific men, conversant with that line of business, have given opinions which are very encouraging.

There may be some difficulty in introducing this mode of condensation into such steam vessels as are already fitted up; at any rate, the necessary alterations would be found expensive; but the obstacles cannot be insuperable, and, if once overcome, the advantages to be derived are very great, and sufficiently obvious. In the first place, that odious nuisance, the iron chimney, which in most vessels is 40 feet high and upwards, may be entirely done away with; and that which would be required to give sufficient draught to the fires, and complete condensation to the smoke, may be enclosed in an ornamental casing, not exceeding the height of 10 feet, and probably not so much; and if the condensed soot and water be discharged within the casing of the paddle wheels, nothing offensive would be visible. Numerous will be the advantages when this improvement is brought to bear. All the insufferable annoyance from smoke will cease, and the rolling of the vessel, occasioned by the great weight and height of chimney, will no longer be felt; nor would the vessel's way through the water be retarded when working against a head wind, if the extent of surface of this great chimney be no longer opposed to it. The vessel itself would, in all respects, have a very different appearance. Cleanliness and comfort, both within and without, would be substituted for misery and filth, and gay streamers and white sails would afford a gratifying contrast to the black canvass and dingy colours which now disgust the sight.

Admitting the different statements I have given respecting the means by which a great force of draught may, when required, be obtained, and complete condensation of smoke, &c. be effected, to be correct; and having shown (I hope satisfactorily) that in situations where circumstances are favourable, smoke may be carried off by drains or passages under ground to an indefinite distance; or, otherwise, immediately and totally condensed, without causing the slightest inconvenience or injurious effect, may I not, without presumption, indulge the flattering expectation that the time will arrive, and at no very distant period, when the lofty chimnies which are now so generally used as a necessary appendage to furnaces of almost every description, will be removed. Manifest advantage has certainly been derived from the use of them, yet still they only lessen, they cannot effectually remedy the existing, evils. I have heard of one chimney at Kidderminster which, if I mistake not, is upwards of 100 feet high; but great as this elevation may be, some unburnt matter, much ash, and all the noxious vapours issuing from the coal, must, notwithstanding, pass into the atmosphere, and must descend to the earth. That the evils produced are still very sensibly felt, and more especially at all our great factories of woollen, cotton, and other fabrics, is amply testified by the new chimnies thus towering, progressively, more and more above those of long standing.

I think it will be recollected by many that Mr. M. A. Taylor expressed, in the House of Commons, a confident assurance, that at no great distance of time London would be as free from smoke and soot as Paris. Without claiming to myself any farther merit, may I not be allowed to ask, whether my plan does not hold out some useful hints towards forwarding his views?

Specification of the Patent granted to THOMAS MASTERMAN, *of the Dolphin Brewery,* 38, *Broad-street, Ratcliffe, Middlesex, Common-brewer, for an apparatus for bottling wine, beer, and other liquids, with increased economy and dispatch.* Dated February 19, 1825.

WITH AN ENGRAVING.

TO all to whom these presents shall come, &c. &c. *Now know ye*, that in compliance with the said proviso, I do hereby declare that my said invention, and the manner of making and using the same, is described and ascertained by the drawing in the margin hereof, and by the following explanations thereof, and by the descriptions and observations hereinafter contained, (that is to say):—

I assume that the liquid I am about to bottle is contained in a cask, well closed, placed on its side, and in a situation proper for bottling the liquid in the usual manner. (It will be seen that the liquid may be contained in any other close vessel, rendered air-tight.)

In the following description, the letters refer to the figure in the margin. *a* (fig. 4, Pl. VI.) is the cask. I drive into the proper hole a cock, *b*, having a nozzle of about four or five inches in length, and having a bore or passage of equal or greater area than the sum of the areas of the whole of the syphons (after-mentioned) added together: *c* is a trough; its dimensions are about 14 inches in length, six inches in breadth, and four inches in depth. It is attached to the frame, *d d*, in such a manner, that its distance from the foot thereof may be increased or diminished at pleasure: *e e e e* are four metal syphons, having each leg of nearly equal length. One leg of each is fixed to the inside of the front of the trough (or that side of it farthest from the cask), the ends being within one inch of the bottom of the trough. The other leg is outside of the trough, and about three inches apart from its said front. The crowns of the syphons are about three inches above the upper edge of the trough: *f* is a trough to catch the liquid that may be spilt while changing the bottles. It is also attached to the said frame, so as to move up or down: *g* is a rail attached to trough *f*, so that it moves with the same trough. Its use is for the bottles to stand on while they are filling. As I shall not have occasion to mention trough *f* again, trough *c* must be understood when I afterwards mention "the trough:" *h h* represents what I designate "the air tube;" the inner diameter of the perpendicular part thereof may be more, but ought not to be less than one inch; the inner diameter of the horizontal part need not be greater than about one quarter of an inch. The cross-piece, *i*, is of solid brass, bored only so high as just to pass the end of the tube soldered into it. The horizontal part of the tube is made of pure tin, on account of its flexibility; the perpendicular part thereof may be made of block tin, or any other metal. The top of this part at *j* is closed. The two parts are connected together at *k*, by a union joint, in order that they may be detached when not in use: *l* is an iron bow or brace, placed across the trough for the purpose of retaining the air-tube firmly in its proper situation. I place the trough under the cock, and fix it so high in its frame that the bottom of the trough may come within an inch of the orifice of the cock. I then fix the air-tube into the brace, *l*, so that the orifice of the tube may be at least one inch above the orifice of the cock; but it ought also to be at least one inch lower than the level of the upper edge of the trough. The perpendicular part of the air-tube ought always to be of such a length that its top may reach (when the tube is fixed as above, ready for acting) higher than the surface of the liquid in the cask. The horizontal part of the air-tube is then bent, so that the cross-piece, *i*, at its end may be, and it then is, driven (air-tight) into a hole, made either through the bung of the cask, or through a hole made for the purpose in the cask, above the surface of the liquid therein.

It is proper to observe, that there must be no passage for air into the cask, except through the air-tube, by means of the orifice at its lower end.

The apparatus being thus adjusted, I open the cock. The liquid then flows into the trough, until it rises so high as to close the orifice of the air-tube. The consequence of this is, that the further admission of air into the cask is prevented, and the flow of the liquid through the cock ceases. I then put the syphons in action, by drawing the air out of them successively by the mouth, applied to a bent tube, one end of which is placed against the end of the syphon, so as to form an air-tight tube with it. As I thus put each syphon in action, I place the bottles so that the end of each syphon enters the necks, and the point to which I desire to fill them is brought on a level with the orifice of the air-tube, the rail, *g*, being adjusted so as to retain the bottles at this elevation. As the bottles fill, the surface of the liquid in the trough sinks, until it descends below the orifice of the air-tube. The instant this occurs, the air rushes into the cask, and the liquid immediately recommences and continues flowing therefrom, until it gains so much upon the discharge through the syphons, as again to rise in the trough so high, as to close the orifice of the air-tube, and then the liquid ceases to flow from the cask as before. Thus, by this alternate action, it is evident that the surface of the liquid in the trough is always preserved nearly on a level with the orifice of the air-tube. As each bottle fills, it is withdrawn quickly from its syphon, and replaced by an empty one. But if the bottles are suffered to remain, they will never fill higher than about the level of the orifice of the air-tube, which it has been shown is the level to which the liquid in the trough is confined.

Where the liquid to be bottled is malt liquor, or any other of a viscid nature, its frothing in the air-tube would prevent the free admission of the air into the cask. I obviate this by placing in the trough, under the orifice of the air-tube, a floating vessel, containing more water than sufficient to fill the air-tube up to the level of the liquid in the cask. This vessel (rising and falling with the liquid in the trough) causes the water in it to exclude the air from, and admit it to the cask, in the same manner as if the liquid in the trough were in direct communication with the orifice of the air-tube.

The above is a description of the apparatus constituting my invention, according to the construction which I conceive to be the best; but the apparatus admits of numerous modifications which still retain the principles of, and are, in effect, my said invention. Those modifications are too numerous to admit of a particular description of each; I shall therefore confine myself to the following one alone. It is evident, from the said description, that the chief principle of my said invention is, the limiting the surface of the liquid in the trough, so that it shall not exceed a certain level or point in the trough, and the maintaining it nearly at such level. In the apparatus before described, this is effected by means of the said air tube; but it may be effected with a sufficient degree of exactness for practice, by substituting for the air-tube the following apparatus:— A valve, of similar construction with the throttle valve of a steam-engine, is fixed in the lower end of the nozzle of the cock. To one of the ends of the pivot on which this valve works (and which end projects to the outside of the cock), is attached a short lever, at right angles with the pivot, and to the end of this lever is attached a float. These several parts are so adjusted that, as the liquid rises in the trough, the float also rises, and causes the valve to shut, when the surface of the liquid has attained its proper level, and of course prevents any further flow from the cock; and as the said level sinks by the liquid running from the trough through the syphons, the float also sinks, and causes the valve to open, and of course restores the flow from the cock. The consequence is, that the surface of the liquid in the trough is always preserved at nearly the same level. It is evident that when the above substitution is practised, the cask must have vent.

Instead of describing any other modification of my said invention, I declare that any apparatus, of whatever construction, whereby the liquid to be bottled runs from the vessel in which it is contained into another vessel, and from thence through a syphon or syphons into the bottles, and whereby the flow of the liquid from the first into the second vessel is regulated by the rising or falling of the surface of the liquid in the second vessel, is to all intents my said invention, and I claim it as such; and I also declare that the using it for bottling liquids, without my permission, will be an infringement of the said letters patent.

In witness whereof, &c.

OBSERVATIONS BY THE PATENTEE.

Letters patent for the apparatus were obtained in the present year for England, Scotland, Ireland, the Colonies, and all other parts of the United Kingdom; and the preceding description of the invention is the copy of the specification of the Irish Patent, which is selected for publication as being somewhat more correct and perfect than the specification of the Patent for England.

Conviction that the common method of bottling liquors is capable of, and indeed requires, great improvement, cannot fail to impress itself on the mind of every one observing that tedious, fatiguing, and wasteful operation; and conviction that the before-described invention has attained its object so perfectly as to render any further improvement almost impossible, will, it is not doubted, equally impress itself on the minds of those who consider the nature and effect of the apparatus attentively.

The simplicity of its construction cannot be controverted: That it obtains the most perfect command over the liquor, will be obvious, from the following enumeration of its advantages.

This enumeration, though too self-evident to be necessary to those who shall have perused the specification with much attention, yet will probably be not unacceptable to others.

As many bottles as will fully employ one workman in changing (and four are found sufficient for this purpose), can be kept filling at the same time. The bottles can be filled to any point required, and the moment they are so filled, the liquor (without the least intervention of the workman) ceases running into them. This advantage affords great facility and relief to the workman. The rapidity with which he can *bottle* equals that with which he can change the bottles; yet he is not precluded from bottling even more slowly than by the common method, or in any intermediate degree. He has not to undergo the fatigue of holding the bottles while filling, nor is a continual watchfulness over them requisite; on the contrary, he may at any moment leave the apparatus in full operation, and it will continue so until the bottles are all filled to the point required, when it will immediately (and of itself) cease to act.

Should a bottle be required to be partly emptied, it is effected by merely elevating it immediately before withdrawing it from its syphon; or should it be required to be filled fuller than the others, withdraw it more slowly from its syphon, and it is done.

The exactness with which the bottles can be filled to any required point, not only prevents any overflow of the liquor, but allows the workman to cork them without even looking where the surface of the liquor in them is. The consequent saving of liquor and of time is considerable.

The very trifling difference of level between the surface of liquor in the upper trough, and the point of discharge of the syphons, renders the stream into the bottles so gentle as not to cause the least frothing, (hardly a bead). This is obviously a great advantage, particularly in bottling malt liquors.

Six dozen of quart bottles have been filled in the space of about ten minutes.

The above fact, coupled with the before-enumerated advantages, indisputably proves the utility of the invention, and the great economy attendant on its use.

The apparatus is of a portable size, and of a very lasting construction.

In our next Number we intend to insert the specification of Mr. John Masterman's invention of a machine "for corking bottles," which is considered capable of being combined in use very advantageously with the above-described bottling apparatus.

Account of various Plans for the construction of a Tunnel under the Thames.

Abstracted from the Papers and Documents of the "THAMES ARCHWAY COMPANY."

WITH PLATES.

AN Act of Parliament having been recently obtained for the incorporation of a company for making a tunnel beneath the bed of the Thames, at Rotherhithe, through which persons, horses, and carriages may pass from the opposite sides of the river; and a sum of nearly 200,000*l.* having been subscribed for defraying the expences of this undertaking, according to the plan for which Mr. Brunel, so well known for his numerous, ingenious, and highly useful inventions, obtained a patent, January 20, 1818, to whom the execution of this work is intrusted; and the public attention having been strongly excited by the actual commencement of this important concern on the 2d of March last, when the first stone of it was laid by Mr. Wm. Smith, MP. for Norwich; we have thought that an account of some of the most ingenious of the plans which were prepared for the construction of a tunnel, in 1809, at the suggestion of a former company, who first attempted this project at nearly the same spot, would be acceptable to our readers, and shall accordingly introduce one of these plans in our present Number, and give the others as speedily as circumstances will permit, concluding the subject with the specification of Mr. Brunel's patent, or an ample detail of his plan, as may be deemed most interesting, with an account of the mode in which the work shall be executed.

The plan which we shall first notice, and several others, were transmitted to the "Thames Archway Company," in consequence of an advertisement inserted, by their order, in the newspapers in February, 1809, offering a premium of 200*l.* for the plan for the construction of a tunnel beneath the Thames, from Redriffe to Limehouse, of which they should most approve; and a further sum of 300*l.* when such plan should be successfully executed. An account of this transaction, and of the history of the tunnel up to that period, may be seen in the 14th vol. of the second series of the Repertory of Arts, p. 397.

The plans sent to this company in consequence of this advertisement, amounted to no less than 54, and were by them submitted to the examination of Dr. Hutton and Mr. Wm. Jessop, who made their report on them the 3d of July in the same year, and recommended that the authors of six of them, which they selected, should be invited to revise their plans, and send farther explanations and descriptions of the same, with which request they complied; and the new or enlarged plans were again submitted to the consideration of the same gentlemen, who, in the August following, selected two out of the six, one of which they recommended "for its enlarged capacity and saving of expence," and the other for being least liable to hazard in the execution; and deferred deciding between them till the authors should reconsider and mature their designs.

The two plans having been sent to their authors for this purpose, and being again returned after due revision and reconsideration, were again sent to Dr. Hutton and Mr. Jessop, who decided in favour of the one, an account of an experiment on the principle of which was published in the second series of the Repertory of Arts, Vol. XXIV.

p. 18, and which was the joint production of Mr. Charles Wyatt and Mr. Hawkins.

Several of the plans rejected had, however, great merit, and some of them would, we have little doubt, be thought by many at least as excellent as that which the judges preferred; though certainly, considering the great experience and knowledge of these gentlemen, and the very great attention which they paid to the subject, their decision must be esteemed of the greatest importance.

But on this point our readers will of course judge for themselves, when they have examined the plans which we shall present to them, and of which the following was one.

Plan for making a Tunnel beneath the river Thames. Signed 1·4142.
Addressed to the "Thames Archway Company."

Gentlemen,—In troubling you with the sketches accompanying this, my hopes are not very sanguine that I shall be entitled to the reward you have offered. Your papers came to my hands at a very late period this month, and at a time when my other avocations would permit me to devote but a very few hours to the subject.

From your printed description I conclude it would be impossible to make an under-ground tunnel, without making it completely under the rock. You would then run the hazard of cutting into the spring you bored into in the bottom of your shaft, with all the difficulties of cutting through the quicksand on the northern side of the river, besides the necessity of either lengthening your ascent and descent very considerably, or making them much steeper. I should therefore prefer cutting it through the river.

The way I propose is, by cutting open the bottom of the river, about 50 feet at a time, first inclosing the space with piles as high, or a little higher, than low water mark; on the top of which should be fastened a cassoon, whose top should reach two feet above high water mark, and which might be floated on and off with the tide, as found necessary.

The bottom of the cassoon is described in fig. 3, (plate VII.) It is there shown with part of the timbers naked, and part covered with a floor. The outside measure is 48 feet by 23 feet 6 inches; in the middle of which is an aperture of 34 feet by 9 feet 6 inches. This opening is intended as a way into the works below, for hauling up the earth, and letting down the necessary materials. This bottom is to be covered with thick planks, except the aperture. Round the aperture is to be raised a strong frame work, well braced, sufficiently high to reach two feet above high water when the cassoon is fixed in its place, with a lining of planks, K, round the outside of this frame-work. Round the outside of the bottom are also to be raised planks, L, with proper knees, &c. similar to the sides of a barge, to the height of four feet; the whole of the planks to be caulked.

The cassoon thus formed will float in the water, and will also be able to carry a considerable weight. It may be said to resemble a great square box, with a hole in the bottom, and a rim round the hole to keep out the water.

My cassoon being made, and afloat, my first step would be to drive 30 piles in the bed of the river, in the direction of the tunnel, in 10 groups (see fig. 6), sufficiently distant to receive the cassoon between them. On the tops of those piles I would lay five cross beams, three of which are shown on the piles, and the other two are omitted, to show more plainly the position of the pile heads.

Those beams and the pile heads should be firmly bolted together, after which the cassoon may be floated on them, placed in its proper position, moored firm, and suffered to rest on those beams with the fall of the tide. It should then be fastened down to the piles, and the water let into it through a scuttle made for that purpose, to prevent its efforts to rise with the following tide. The pile engine may then be placed on the cassoon, and piles driven all round it close to the former ones. They should be driven, if possible, down to the rock; or, if the clay is too hard to drive through, it must be bored to receive them, using an iron cylinder, or section of one, in boring through the gravel, to prevent its running into the hole.

When the piles are all driven, they should be bolted to the bottom of the cassoon; then frustrums of triangular prisms, made of wood, should be driven into the interstices, between the pile heads and the cassoon, and the whole caulked as far as the water will permit.

I prefer driving double rows of piles, corner to corner, as shown in the plans, instead of single piles, side by side, for the following reasons :—

1st, It is the strongest way of the timber.

2d, It affords a better chance of driving them nearly water-tight; but it being impossible to drive them perfectly close, or accurate, by driving the row next the cassoon first, and afterwards driving the outer row, with its angle in the interstices of the others, with the bottom end of the pile shaped and shod, so as to draw towards the interstice, in driving there is a greater chance of making the whole tight. In the outer row of piles I would champher off a part of the two sides that came in contact with the inner row, as shown in the piles, A B, fig. 5, so as to leave a wedge-like opening, as at C D and E, next the water, for the purpose of filling it with oakum, thin wedge like slips of wood, or other matter, that might be necessary to fill any of the joints where the water may be found to pass through, and which the water itself would force into the interstices.

My piles being drove, and made as tight as possible, both among themselves and to the cassoon, the next thing is to pump out the water, and place the interior framing, G H, fig. 1, to resist the pressure of water against the piles; then sink down to E F, fix that framing for the same purpose ; then down in like manner to C D, which would be the last framing.

Then excavate for the bottom of the tunnel, and build it.

The cross beams extending from C to D might be taken out one by one, and the holes filled up with brick-work, when the tunnel is banked up sufficiently high to secure the feet of the piles at bottom, placing other shores across the tunnel to prevent its pressing together before it is loaded.

The tunnel I propose a complete circle of 13 feet diameter inside, with a carriage way of 7 feet 9 inches between the curbs, a footway on one side, and lamps the other. The thickness of the wall to be three bricks; but as this would be buoyant if the water got under it even with two feet of clay on it, and it ought to be placed sufficiently deep that it should not be injured with anchors cast in the river, I would place the top of the tunnel at least six feet below the deepest part of the river, and cover the whole of it either with a good puddle, or well-tempered and rammed clay.

I conceive in working the tunnel from one way only, it will be necessary after the first length is turned, to have a second cassoon and second sets of piles, placed next the first, and both empty of water at the same time; for in order to join the second length of tunnel to the first, it will be necessary either to cut away the ends of the end piles from between the two lengths, sufficient for the arch of the tunnel to be brought under them, or the end piles must be drawn and replaced again, with the lower ends close to the tunnel after the two lengths are united.

The second length of tunnel being finished, a third cassoon and third set of piles will become necessary, for the first must not be removed until the tunnel is continued from the first length in the contrary direction. The way I would therefore work should be thus:—

My first cassoon, and consequently first length of tunnel, should be placed with its middle nearly over the letter *h*, in your engraved section, (See Repertory of Arts, second series, Vol. XIV. p. 397) where I would avail myself of your present driftway, by sinking through the rock and driving into it, for the purpose of draining the work as I went on.

My second cassoon, and second length of tunnel, should be towards the Surrey shore; my third would follow it in the same direction. I would then shift my second, letting the first remain, and so on alternately with the second and third, until I got landed on the Surrey side.

I would then return again to the first, and work across the river in the contrary direction, by alternate shifting as before, taking away my first cassoon, which, after one length was worked from it in the northward direction, would become useless.

I do not conceive that any of the piles by the sides of the tunnel could be drawn after they are once used; the only thing that can be done in that case will be to cut them off even with the ground.

Two or three ports might be made in the sides which inclose the aperture in the middle of the cassoon, one above the other, through which the earth taken out, or bricks, &c. to be taken in, might be passed, instead of drawing the whole up to the top, when the tide was low, using the lowest when the tide was out, and shutting that and using a higher one as the tide rose.

If the piles here shown should, on trial, be found insufficient to keep out the water, the only way then left would be, to drive another row of piles, at a distance from those already supposed to be drove; clear the bottom of gravel between them, and form a coffer-dam between those last piles and the former ones.

It will be observed I have only contemplated a single tunnel; but two of this kind will be necessary, one for carriages, &c. passing northward, and another for those passing southward, and it would be much the cheapest to make both at the same time.

May 31, 1809. 1·4142.

References to Plate VII.

Fig. 1, A B, line of lowermost timbers of cassoons; C D, E F, G H, interior framings; I I, upright framing round aperture; K K, braces to ditto; L L, outerside of cassoon; M M, piles; N, footway; O O, stones worked in the tunnel to support the footway and curb; P, bottom of the road; Q, high water line; R, low water line; S, bottom of river; T, gravel; U, earth inclining to clay; V, loam; W, earth inclining to clay with shells; X, rock. Fig. 2. Longitudinal section of the tunnel, pile work, and cassoon. A, bottom beam of cassoon; B B, ends of timbers of the lower framing, appearing through the tunnel; C C, piles behind the tunnel; D, piles for one length of tunnel; E, part of piles for another length of tunnel; F, high water line; G, low water line; H, ground line; I, top of tunnel; K, bottom of ditto. Fig. 3. Plan of the bottom of cassoon, (A B in fig. 1.) I I, piles; K, lining of planks round the upper frame-work; L, ditto round the outside of the bottom; M M, apertures; N, plan of part of piles for the second length shown under the cassoon. Fig. 4. Plan of the tunnel and frame-work, (C D in fig. 1.) I, part of the piles. Fig. 5. A B F G H, piles, showing their position at one of the beams supporting the cassoon; C D E, wedge-like openings; I, beam under cassoon, resting on the piles. Fig. 6. Plan of piles and beams, preparatory to fixing the cassoon.

Report of the Select Committee of the House of Commons, appointed to inquire into the state of the law and its consequences respecting the Exportation of Tools and Machinery.

Ordered to be printed June 30, 1825.

It is necessary, for the purpose of reporting fully to the House on this subject, to advert to the proceedings of the Committee, appointed in the last Session "to inquire into "the state of the law in the United Kingdom, and its con-"sequences, respecting artizans leaving the kingdom and "residing abroad; also into the state of the law and its "consequences respecting the exportation of tools and "machinery; and into the state of the law and its effects, "so far as relates to the combination of workmen and "others to raise wages, or to regulate their wages and "hours of working, and to report their opinion and obser-"vations thereon." From the minutes of evidence taken before that Committee, it appears that a considerable number of persons were examined respecting the exportation of tools and machinery, and the laws relating thereto, and that considerable apprehensions of evil from the repeal of the laws which forbid the exportation of tools and machinery were entertained by many persons engaged in the manufacture of cotton goods, lace, &c. and also by some manufacturers of machinery, whilst other manufacturers of machinery, persons of great experience and intelligence, were decidedly of opinion that the prohibition to export tools and machines was beneficial to no one, and highly injurious to the commerce and manufactures of this and other countries. The Committee, therefore, in order that a more correct judgment might be formed on matters of so much importance, refrained from proposing any measure to the House at that time, but came to the following resolution:

" That your Committee have examined evidence respecting the export of machinery, which will be found " in the appendix; but they are of opinion, that further " inquiry and a more complete investigation should take " place, before this important subject can be satisfactorily " decided on; and they therefore recommend, that the " consideration of this important question should be resumed in the next Session of Parliament."

With respect to the laws which forbid the exportation of tools and machinery, and their general inefficiency to accomplish the ends for which they were enacted, very conclusive evidence was given by Mr. Dean, the Chairman of the Board of Customs, by several of the principal officers of the Customs, and others.

It appears that in consequence of some tools and machines being legally exportable, and others being altogether prohibited, and from the circumstance of new tools and machines being daily invented, and not prohibited by name in any Act of Parliament, it is extremely difficult, and frequently impossible, for the officers of the Customs to decide upon what is and what is not prohibited to be exported. Every one of the officers examined by the Committee proved the inadequacy of the laws for the purposes intended, and expressed their doubts as to the possibility of any law being rendered efficient, while any tool or machine whatsoever was permitted to be exported. It was also proved by several witnesses, that considerable quantities of prohibited machinery was exported; and the minutes of evidence accompanying this report exhibit a system of smuggling carried on to a considerable extent. This system is safely carried on by the insurance of the machinery which is prohibited by law to be exported; and there is reason to believe that, in regard to the exportation of such prohibited machinery to France, the premium paid to the insurer does not much exceed the duty charged on the importation of such machinery into that country.

Your Committee cannot better express themselves on these subjects than by extracting a part of the evidence taken, (viz. Mr. Galloway's):

" Could you at the present moment, if you wished to " export cotton or other machinery, do so by paying the " insurance ?—Yes, any quantity; the greater the better.

" Then are you of opinion that the laws are not effectual " to prevent those articles that are prohibited, from being " exported ?—They are wholly inefficient, both as regards " direct and indirect exportation; the direct mode of " sending out machinery in quantities I have stated; the " indirect mode is accomplished by mixing the prohibited " with the unprohibited articles: it is worth any man's " while to order a quantity of *unprohibited* machinery to " get out a quantity of *prohibited,* for under this mode it " is very difficult to separate *prohibited* from *unprohibited* " machinery, and this never can be detected by Custom- " house officers.

" Then while the exportation of machinery and tools to " any extent is allowed, it is impossible to prevent the " exportation of prohibited machinery ?—You never can

" prohibit every kind of machinery from going, while you " permit any to go; it must either be wholly open or " wholly closed; there can be no middle course.

" What is the highest rate of insurance for the safe " transit of goods illegally exported, the highest that has " come to your knowledge?—I think it is from forty-five " to thirty per cent. the large premium for small quantities; " if I had 20,000*l.* worth to send, I should pay thirty per " cent. to any port in France; but for 1000*l.* or 1500*l.* " perhaps forty per cent. would be required; the reason " is, that a vessel engaged in such commerce is subject to " all the inconveniences in taking 1000*l.* worth that it " would for 20,000*l.* and the profit on small quantities of " machinery is not equivalent to the increased price of " insurance.

" Do you know how persons export prohibited machi" nery?—I know of no other means but those I have ex" plained. A circumstance, that is perhaps a little curious, " came to my knowledge, that the officers, two or three " years ago, actually seized a quantity of machinery going " to France, and some of that machinery was sold at the " Custom-house, and bought, and sent there to the person " afterwards in France, who originally ordered it, and that " transaction, I understand, took place last year; and I " believe the Government and the Custom-house employed " all due diligence, but the plans of the shippers were so " complete, that all the precaution and diligence of the " Custom-house went for nothing."

Evidence was given before the Committee of 1824, and also before this Committee, that a considerable portion of prohibited machinery consists of such ordinary and common parts and pieces of machines, applicable as well to machines which are not by law prohibited, as to those which are prohibited, so that it is difficult, if not nearly impossible, for any one to say that they are actually parts of a prohibited machine. Other machines or parts of machines may be disguised; many parts of prohibited machines are so small that they may be easily concealed, while other parts, by being packed with tools that can be exported, and also by exporting them from different ports, may be so disposed of as to render detection impossible.

"There are vast numbers of packages," says Mr. St. John, Controlling Searcher of the Customs in London, "which we open, where there are parts of machinery "packed with other iron and steel articles from Birming-"ham, purposely packed for deception; and it is almost "an impossibility for an officer to know whether they are "or are not prohibited, being only parts of machinery." To the same effect it is stated by Mr. Boyd, General Surveyor of the Customs: "Out of a vast number of packages "exported, but a small proportion can be opened at all; "and in opening a proportion of those packages occa-"sionally, they do discover something that is machinery; "but it is always in detached pieces and in parts; large "machines cannot all be made up in one package, and "they have a great deal of difficulty in telling whether "those proportions belong to a machine that is prohibited, "and a great many pass in packages which are not opened "because they cannot be opened. It is a very rare oc-"currence indeed to meet with prohibited machinery "which *appears* so."

It is however asserted, by Mr. Ewart and Mr. Kennedy, that if the searchers at the Custom-houses were well instructed, that they might distinguish the prohibited from the unprohibited machinery, admitting at the same time, however, that it would be difficult to put the law rigidly into effect.

Considerable discrepancies in the laws were also pointed out by the officers of the Customs and other witnesses: thus, presses of all sorts in metal, with or without the screw, is a prohibited tool, but the screw alone is not a prohibited tool; and hence it follows, that nothing belonging to a press is prohibited, except the frame, which is the least important part, and that too, when sent in pieces, which it may be, is not considered a frame. In other cases tools and machines are prohibited, but the tools to make them are not generally prohibited. Lathes, with the exception of potters' lathes, are not prohibited, be their power ever so great. Steam engines are not prohibited, and yet by means of steam engines and lathes, with other common tools allowed to be exported, almost every other tool and machine may be manufactured.

It was stated to the Committee, that newly invented machines in the iron or steel manufacture, might generally be exported; but that those in the cotton, woollen, linen, or silk, if known, would be prohibited; and all the gentlemen from the Custom-house affirmed that the law was so defective, that, by a little contrivance, the facility of evading it was such, that "all the block machinery at Portsmouth "might be exported."

Much more might be stated from the evidence on this subject; but enough, it is hoped, has been brought forward to show the inefficiency of the laws intended to prevent the exportation of machinery and tools; and it must be evident to every one, that laws that cannot be executed, and thereby become an incentive to fraud, ought either to be amended so as to render them efficient, or totally repealed.

Another important part of the inquiry relates to the policy, in a political and commercial view, of prohibiting the exportation of tools and machinery, upon the supposition that the laws could be rendered efficient to that end. And here your Committee beg leave to observe, that at the times when the several laws were made which prohibit the exportation of tools and machinery, very erroneous notions were generally entertained in regard to commerce and manufactures. It was then a received opinion, that the liberty of exporting any thing that was likely to increase the commerce and manufactures of another country, would be injurious to those of the country from which the exportation was made; and hence arose those various enactments respecting trade, as well as those which prohibit the exportation of tools and machinery from the United Kingdom.

Fig. 1.

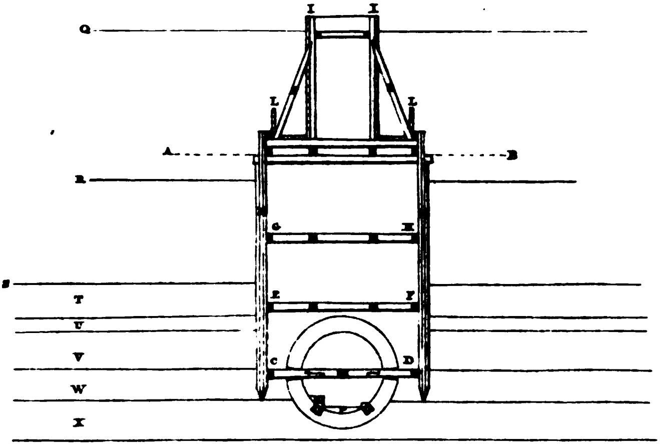


Fig. 2.

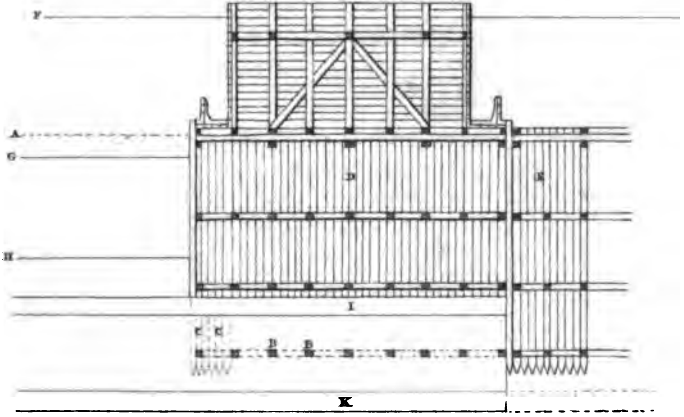


Fig. 3.

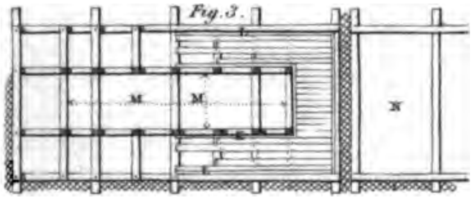


Fig. 5.

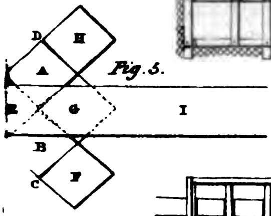


Fig. 4.

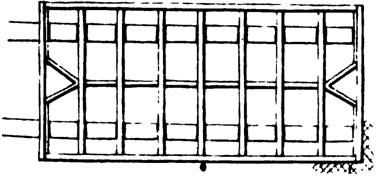
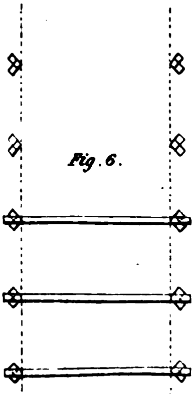


Fig. 6.



The history of the acts which still remain on the statute book relating to the exportation of tools and machinery, would, if unfolded, show both from the intervals of time which elapsed between the passing of these acts, and the perplexity which prevails in the enactments themselves as to what may or may not be exported, that no fixed principle was kept in view, but that they were dictated by a mistaken jealousy of permitting other nations to benefit by our improvements. In order, however, to draw the attention of the House more particularly to the present state of the law respecting the exportation of tools and machinery, your Committee have deemed it proper to put, in an Appendix to their Report, the various clauses of the existing statutes relating to this subject; the slightest attention to which, in the opinion of your Committee, will be sufficient to confirm the observations which they have thought proper to make upon them, and the recommendation with which they have closed their Report.

The first act pointed out by the Commissioners of the Customs, as a rule for their conduct, is the 7th and 8th of William 3, (1696,) when the exportation of the new stocking frames (invented by William Lee, AM. of Cambridge, about the year 1600) was first prohibited, being about 100 years after their invention, and nearly 30 after their introduction into France; and it will be seen by sect. 9, that even the removal of these frames from place to place in England, was prohibited in all cases, unless due notice was given to the company of frame-work knitters in London. It is still illegal to remove any of these stocking frames from one town or place to another, although it would be altogether impossible to give the notice required, or to obtain such leave, as the frame-work knitters company has ceased to exist for upwards of half a century.

To be continued in our next Number.

Description of a Udometer, a new instrument, which shows the quantity of rain fallen. By M. Nicod, *of Vevay.*

(From the Bibliothéque Universelle.)

This instrument is composed of a circular basin, made of tin-plate or copper, the outer edge of which is surrounded by a double inclosure, forming a canal. An opening is made six lines above the bottom, so that the basin cannot become full of water, but all the rain that falls into it runs out, through this opening, into a receiver placed beneath. Through the whole height of this vessel there is a vertical slit, covered by a strip of glass, which closes it hermetically, and allows the height of the surface of the water in the vessel, and all its variations, to be seen. A scale, divided into inches and parts, is marked at one side: and a tube, closed by a cork, serves for emptying the vessel when it is full of water.

The basin communicates, by a closed canal above, with another and a smaller basin, surmounted by a cylindrical reservoir, which has likewise a longitudinal opening, closed by a piece of glass, in the same manner as in the larger basin. At the side a scale is marked, which is lengthened in the ratio of the difference of the diameters of this reservoir and of the large basin. This reservoir, which is filled with water before it is put in place, being constructed like the reservoirs which supply oil to the wick of an Argand lamp, replaces the water which evaporates from the large basin, by means of the canal of communication.

The effect of this instrument is as follows:—when it rains, all the water that falls into the large basin passes into the receiver below, where the quantity of it may be afterwards measured. When the rain is over, and evaporation begins to take place, the water which evaporates from the large basin is immediately replaced by the water contained in the little reservoir, and the scale on the latter shows at once the quantity.

Account of a large refracting Telescope, constructed by M. Fraunhofer, in 1824.

(From Schumarcher's Astron. Nachricten, Nos. 74 and 75.)

THIS instrument, which is one of the largest of its kind, is intended for the Imperial Observatory at Dorpat. Its object glass has 108 Paris lines in diameter, (9·592 English in.) and 160 inches focus, (169·75 English in.)

A great impediment to the observation of celestial objects by large telescopes, is the apparent diurnal motion of the stars, which increases in proportion to the magnifying powers of the instrument; so that stars lying near the equator remain but a short time within its field of view, and traverse it very rapidly. However small may be the motion given to the instrument by screws, for the purpose of following them, it will receive oscillations, which will be larger as its powers are greater. Before the instrument has come to rest, the star will have crossed the field of view, so that the observer will see it perhaps only for a few moments, and as it were by accident, under favourable circumstances; which circumstances will be more rare, as a star is only seen to advantage in the centre of the field. These difficulties could only be removed by making the telescope follow the stars by machinery, whether their motion was apparently slow, as at the pole, or rapid, as at the equator.

To obviate these difficulties, this telescope has been mounted in a peculiar manner; one of the two principal axes on which it is made to turn, is so inclined towards the horizon, that its inclination may exactly correspond with the latitude of the place, and is consequently directed towards the pole. The second axis, called the axis of declination, is exactly vertical to the first or hour axis. Thus, by directing the instrument towards a star, the hour axis need only be moved with that velocity which will make it turn round once in 24 hours, like the axis of the earth; by which means the star will always remain in the field of view, as long as it remains above the horizon. This motion is imparted to that axis by means of clock-work, consisting of two distinct parts. The power of the one part (moved by a weight), overcomes the resistance and friction of the mass of all attached to the telescope, which amounts to several hundred weight; the other part regulates the motion. But in order to prevent concussion in the motion, and make it uniform, the clock-work, instead of being regulated by the usual vibrating pendulum, is governed by a centrifugal pendulum, which, inclosed in a hollow cone, turns always in one direction, and both the parts of the work may be wound up, without the motion of the telescope being interrupted in any degree whatsoever. The telescope may also be stopped, and again set in motion, without arresting the movement of the clock-work; and if required, it may also be moved in any direction, either by the hand, or by means of a screw. The motion of the clock may at any time be accelerated or retarded, by simply moving a spiral disk to a different degree of its division. By this means a star may be moved to the centre of the field of view, which is peculiarly useful in micrometrical observations, and is not practicable in any other manner. By means of this disk we may give the telescope instantly the movement corresponding with that of the moon, or any of the planets.

In order to render an uniform motion of the telescope possible, it must be completely balanced with respect to its two principal axes, in whatever position it may be brought, without, however, this balancing occasioning any impediment to its being directed towards any point of the sky that may be required. With respect to the axis of declination, the telescope not being fixed on its centre, is balanced by two weights, placed near the eye-glass, and fastened to two conical brass tubes, each having in the point of gravity an axis, intersecting that of the other at right angles; so that in this respect the telescope is balanced in every direction. With respect to the hour axis, the telescope is balanced by two weights, one of which is fixed immediately on the axis of declination. The second weight is fastened to a bar of a peculiar shape, forming a ring towards the hour axis. This ring touches (by means of two other axes placed opposite each other) a second and smaller ring, which ring turns on the case that contains the axis of declination; so that also with respect to the hour axis, the telescope is balanced exactly in every direction. In order to prevent the friction of the hour axis, and its pressing on its bed, another weight is added, operating on the bed of two friction rollers. By all these arrangements, the telescope, notwithstanding its size, may be moved by one finger.

The pedestal is of such a shape, that although its position must never be altered, it cannot hinder the telescope from being turned towards any point of the heavens. It might seem that there were situations of the telescope in which the pedestal may be an obstacle against following the star; yet the instrument is so constructed, that the telescope may be directed in two ways on the same object, simply by turning the hour axis 180°. Thus, if the pedestal be an obstacle on one side, the turning this axis will render the telescope free on the other side.

As it is very difficult with a large telescope to find an object, and bring it within the focus, it is usual to add to it a small one, the axis of which is perfectly parallel with that of the large one. The finder of this large refractor has 29 lines diameter (2·57 English in.), and 30 inches focus, (31·97 English in.)

Each of the two principal axes has a graduated circle, called the hour and declination circles. These are fastened to the axes, and turn with them. The division of the hour circle shows four seconds of time, and that of the declination circle, 10 seconds of space. By this means those stars which are out of the meridian may also be found and observed in the daytime, which cannot be observed so well in many particulars at night.

In the line-micrometer belonging to this instrument, both threads may be separately moved by a screw; partly for the purpose of placing each thread where it may be required, and partly for enabling the observer to make a kind of repetition in the observations with micrometers, which, with the use of the clock work that moves the telescope, is much more practicable than in the common way of mounting. In the same way the eye-glass is separately moveable, in order to make the two threads stand always equidistant from the centre of the field of view, which makes them both equally distinct. That part of the micrometer containing the threads, supports, besides the necessary correction screws, &c. two graduated verniers, in opposite positions, moving upon a graduated circle, made for measuring the angles of position. The verniers read off to one minute. The micrometer may be gently moved, with respect to the position circle, with the hand or by a screw. The lines only are capable of being illuminated, leaving the rest of the field of view quite dark. As the position circle must remain unalterable with respect to the position axis, but the micrometer, together with the apparatus for lighting the threads, must be capable of being turned, M. Fraunhofer was obliged to make a disposition of it different from that which he had before employed with micrometers without a position circle. The whole field may also be lighted. The micrometer has four distinct eye glasses.

The telescope is to receive moreover a lamp circle micrometer, with four eye glasses; a lamp net micrometer, with three eye glasses; and finally, four ring micrometers, two of which contain double rings.

As distinctness can only be properly obtained by the axis of the object glass, and that of the eye glass being exactly in the same line, and a deviation in this respect being more injurious in large object glasses than in small ones, a particular instrument is to be added to the telescope by M. Fraunhofer, by which this deviation may be found and corrected.

M. Fraunhofer states in the beginning of his memoir, the advantages which refracting telescopes have over reflectors, the most perfect of the latter requiring to be of immense size to produce any effect, from their reflecting but a small portion of the light which they receive. The impossibility also of rectifying the deviation of the rays, caused by the spherical form of their reflecting surfaces, have caused refractors to be preferred for mathematico-astronomical observations, and for meridional instruments.

The glass of the refractors, on the other hand, lets all the rays pass, which, with the contrivance of Mr. Dolland for making them achromatic, and other improvements, have caused almost all astronomical observations to be performed by their assistance.

The largest refractors hitherto made, are but small in comparison with the largest reflectors. It is well known that the effect of the telescope lies not in its length, but in the diameter of its object glass; and that in those in which this is double the size, the power will also be double. Mr. F. computes that the difficulty of making large achromatic telescopes, is nearer in the ratio of the cube of the diameter of the object glasses, than in that of their diameters directly. One of the difficulties was, that the glass used for object glasses could not be obtained as perfect as large instruments required. The English flint glass has undular lines, which disperse the light irregularly in its passage through it; these streaks being of course more numerous as the glass is thicker and larger. The English crown glass has also these undular streaks, although not always visible to the naked eye. The Bavarian flint and crown glass is, however, free from these streaks, and equally compact throughout. The difference between these two sorts of glass, in the power of dispersing colours, is also in favour of the Bavarian glasses. Between the English flint and common glass this power is as 3 to 2, while in the Bavarian flint glass it is as 4 to 2, which gives the latter a decided preference.

There were not any fixed theoretic principles for the construction of achromatic object glasses, and opticians were obliged, to a certain degree, to rely on chance, and to polish a greater number in order to select the best; and this chance became less as the glasses were larger. This arose both from the means formerly applied for ascertaining the powers of refraction, and dispersion of colours in the different species of glass, not being sufficiently established; and from the methods hitherto used for grinding and polishing the glasses not being calculated to follow the theory with that degree of exactness which they ought, to avoid palpable indistinctness.

M. Fraunhofer states that all these impediments, and several others, have now been successfully removed, partly by inventions and partly by discoveries, to which he was led in pursuing this object; and gives us reason to expect that he will favour us with an account of them, having declared the probability of his entering more largely on this subject on another opportunity.

A plate of this large refracting telescope may be seen in the second volume of the Memoirs of the London Astronomical Society.

Notice of the existence of Iodine in the Mineral Kingdom, by M. VAUQUELIN.

(From the Annales de Chymie, Vol. xxix. May, 1825.)

IODINE has not been found hitherto but in certain vegetables, and in some marine moluscas. M. Cantu, professor of chemistry at Turin, has indeed discovered some traces of it in a mineral water of Asti; but no one that I know has as yet found it combined with minerals.

Mr. Joseph Tabary having sent me a few weeks ago some argentiferous minerals, which he had bought from the natives of South America, and in part collected himself in the vicinity of Mexico, in an extent of 25 leagues radius, to determine the quantity of silver contained in it, and that of the gold, if any of this latter should be found, has furnished me with the fortunate opportunity of making the discovery which I have now the honour to lay before the academy.

One of those minerals, which was labelled "*Virgin Silver of Serpentine,*" (and of which the physical properties are—1st, A whitish colour at its surface, where worn by rubbing, and exhibiting grains of metallic silver; 2dly, A laminous fracture, of a greenish yellow, with some black parts and some metallic silver), is that in which I have found iodine.

Twenty grains of this mineral, treated with nitric acid, were attacked with effervescence, and the developement of nitrous gas towards the end. After having boiled it for a considerable time, the liquid diluted with water exhibited two substances; the one, very heavy, was quickly precipitated; the other, being light, remained a long time suspended in the liquor. They were separated from each other by decantation, washed and dried.

The first, which weighed 6 grams and 42 centimes (120·88 grains), was easily fused by the blowpipe, giving out a purple flame, and, at the end of some time, a globule of silver appeared in the midst of the fused matter, which spread itself over the charcoal in the manner of chlorite of lead. The edges of the charcoal were coated with a yellow powder.

The other matter, which was brown, weighed 2 grams, 70 centimes (50·84, or nearly 51 grains). It inflamed by the heat, in giving out an odour of sulphurous acid, and left a residue of sulphuret of lead, mixed with a little iron, which weighed 1 gram 58 centimes (29·65 grains).

The first matter, that which weighed 6·42 grams, being treated by muriatic acid with heat, communicated to it a reddish brown colour, and produced a slight effervescence with an odour of chlorine. In proportion as the temperature was increased, this effervescence became more lively, and presently it assumed a beautiful violet colour: immediately the vessel was taken from the fire, that the violet substance might not be lost. There remained at the bottom of the acid a yellow matter, containing grey particles, which dissolved in the warm water, with which this matter was washed.

This water acquired a reddish brown colour, and the property of colouring a solution of starch a beautiful blue. After having passed water many times over this matter, we boiled it with alcohol, which became coloured in its turn in a manner much more intense, and which equally acquired the faculty of forming a blue combination with the solution of starch.

Suspecting, but without, however, believing it (so much did the circumstance seem to us extraordinary), that this violet vapour was produced by iodine, we submitted the above muriatic solution to distillation, after having diluted it with a little water. We then with pleasure saw that our suspicions were realized. In effect, the violet vapours which arose, immediately crystallized on the sides of the adopter and of the balloon fitted to the retort, in assuming the needle form and the colour, which are peculiar to iodine; but the acid was not entirely discoloured.

Although the yellow matter had boiled some minutes with the muriatic acid, it was not however entirely decomposed; for having fused 2 grams 28 centimes of it with 2 grams of potash, and having washed the result with water, we obtained an alkaline lee, which, saturated with sulphuric acid, and mixed with starch water, gave a very beautiful blue colour by the addition of a few drops of chlorine. The part which was not dissolved in the water, was a powder of metallic silver, weighing 1 gram 63 centimes (30·60 grains).

Being convinced by the foregoing experiments of the presence of iodine in the argentiferous mineral, we sought to obtain it by a way more direct, which would permit us to determine the quantity, and to know the mode of combination in which this matter was found.

In consequence, we caused 5 grams (94·15 grains) of it, in powder, to be heated with 2 grams (37·66 grains) of caustic potash, with a little water to facilitate the mixture. The matter being kept red hot some time, we mixed it with water, and after having decanted the latter, we washed the residue until it was no longer alkaline. This residue was a dirty yellow, and weighed 4 grams 46 centimes (83·98 grains). We will return to it presently.

A portion of the alkaline lee being saturated with nitric acid took a yellow tinge, and had the property of making starch blue on adding to it some drops of chlorine. In fine, it was precipitated of a blackish brown by nitrous acid, and of a red by nitrate of mercury.

The 4 grams, 46 centimes, remaining after the action of the potash, being treated with diluted nitric acid, became dissolved with effervescence: but there remained a yellowish substance, which resembled nearly, in the colour, chlorite of silver. Being washed and dried, this matter weighed 80 centigrams (14·86 grains); it became a yellow orange by the heat, and returned to a yellow green by cooling.

We ascertained that this matter was iodite of silver, which proved that the alkali had not effected the complete decomposition of this substance, although it was in excess. The quantity of silver dissolved by the nitric acid was 41 centigrams and a half (7·81 grains).

The potash having thus taken up 50 centigrams from the 5 grams of the mineral, which could be nothing else but iodine, and as we had obtained besides 80 centigrams of the iodite of silver, in which there is contained, according to the modern chemists, 42½ of iodine, it follows from this that these grams of the mineral contain 92·50 of iodine, which, being divided by 5, gives 18·50 for the 100 of the mineral.

There remained no more doubt with us of the existence of iodine in this silver ore. However, we wished to know if we could obtain the hydriodite of potash crystallized. For this purpose we saturated with sulphuric acid the excess of alkali contained in the lee, of which we have spoken above; and after having evaporated it to dryness, we treated it with alcohol of 30°, to separate the sulphate of potash. We then evaporated the alcohol; and the mother water, abandoned to spontaneous evaporation, furnished crystals in square prisms, which had all the properties of common hydriodite of potash.

From henceforth then iodine may be considered as one of the elements of minerals; and this will be a motive for chemists not to neglect the search for it when they analyze metalliferous minerals, particularly when they contain silver; for, as well as chlorine, iodine has a great action on this metal.

To which of the substances contained in the silver ore iodine was united, is now to be determined. It may be recollected that we found in it sulphur, silver, lead, and carbonate of lime, which served as the gangue. We may at once exclude the carbonate of lime. The difficulty of decision exists only between the sulphur, the lead, and the silver. It is not at all likely that this matter should be united to the sulphur; this latter, as well as the lead, being laid naked by the nitric acid, even when diluted, on the silver ore. There is more probability that the sulphur is united to the lead, and to a part of the silver. On the other side, if we consider that, in proportion as the nitric acid dissolves the metallic silver, and decomposes a part of the sulphuret of lead, it throws down the iodite of silver, on which nitric acid has no action, we shall be disposed to believe that the iodine is combined with the silver. Besides, what seems entirely to confirm this opinion is, that we can take from the silver ore a certain portion of iodite, by boiling it for some time with ammonia. Finally, it is well known that iodine, as well as chlorine, has a great affinity for silver.

I will deposit in the cabinet of the King's garden what I have remaining of this mineral, to serve as a point of comparison, in case the locality of this mineral should hereafter come to be discovered.

Extract of a Report made to the French Academy, by M. AMPERE, *on the dry (galvanic) columns of M. Zamboni.*

(From the Annales de Chimie, Vol. xxix. June, 1825.)

AN account has been published of experiments made with dry galvanic columns in 1810, by Mr. Forster, of Essex, which had been previously invented by M. de Luc.

The application which has been made to chemistry of galvanic apparatus of a more expensive composition, and the several curious facts which have been discovered by its means, give the circumstances mentioned in the following memoir a considerable interest, especially when we recollect that dry galvanic columns, besides being much cheaper in the first instance, require no expence for acids of any kind, which for the larger combinations of galvanic troughs often come to a serious amount, and also that they demand no cost for repairs or renewal of their parts, being as perfect at the end of several years as at the first experiment.

The original memoir, besides the description of some apparatus which the dry galvanic columns kept continually in motion, contains also an account of the several following facts.

The diminution of the energy of the dry columns ceased at the expiration of two years. M. Zamboni asserts that he has ascertained this by the experience of twelve years.

This diminution, in the two first years, varies according to the manner in which the columns have been constructed.

The dry column is more energetic in summer than in winter, as well with regard to the intensity produced, as to the promptitude with which it becomes manifest.

The tinned paper, called *silvered paper*, exhibits with the black oxide of manganese an electric force, very superior to that which is obtained when the paper is covered with thin leaves of copper; which last sort of paper is known by the name of *gilt paper*.

A pile formed of disks of paper, tinned only at one side, without any other substance interposed, produces electric effects, which can only proceed from the leaf of metal *glued* to the paper, touching it more intimately than it is touched by the paper of the next leaf which is placed beneath it.

M. Zamboni has examined in the columns which he calls *binary*, if the action of the plates is the same as in those composed of leaves of tin, covered with oxide of manganese, or the contrary, and he has acertained that either of those results may be obtained at pleasure, by causing the paper which is glued to the tin leaf to imbibe different substances. If oil is used, the action is the reverse of that produced by the oxide of magnanese; but if on the contrary, honey, any alkali, a solution of sulphate of zinc, or milk half curdled, be introduced into the paper, the binary pile acts in the same manner as that which is powdered with oxide of manganese.

In making use of a dry column of a thousand pairs of plates, which were only between 5 and 6 centimetres (between 1$\frac{4}{8}$ and 2 in.) in diameter, M. Zamboni obtained from the condenser sparks of an inch in length, so that with this column an electric battery may be kept constantly charged to an intensity that may be rendered as great as is desired, by multiplying sufficiently the number of plates.

M. Zamboni thinks that a pile of 50,000 pairs of plates, left of the full diameter which the leaves of tinned paper commonly have, would afford a constant source of electricity, the intensity of which would equal that of a powerful common electrical machine. He expresses strong wishes that an instrument of this magnitude may be constructed, and mentions many interesting experiments which might be performed by its assistance.

On Blowing Machines and on the Expansion of Air. By WELTER and GAY-LUSSAC.

(From Archives des Decouvertes.)

IT is known that when air or any other elastic fluid is dilated, by enlarging the space in which it is inclosed, cold is produced. Messrs. Welter and Gay-Lussac, who have been engaged in researches concerning the heat disengaged by the gases, when their volume is varied under very different pressures, have already discovered several new facts, one of the most singular of which is the following:

The air which escapes from a vessel by blowing through an aperture under any pressure whatever, does not alter in temperature, although it expands on issuing from the vessel.

Hence it should seem to result, that heat is produced in the blowing of air, and that this heat is so much the more considerable as tho difference of pressure producing the blast is greater, so that the heat exactly compensates for the cold produced by expansion. This fact would explain the heat produced when air enters into a vacuum, or into a space occupied by air at a less pressure.

It would likewise explain why the blast of the Shemnitz machine (with a column of water), produces cold and freezes water, while the air of the Chaillot engines, where the pressure is invariable, and equal to 2·6 atmospheres, does not alter the thermometer.

NOTICES OF NEW PATENTS.

Patent granted to Mr. WILLIAM JAMES, *of Westminster, Land Agent and Engineer, for improvements in the construction of rail and tram roads, or ways which are applicable to other useful purposes.* Dated February 28, 1824.

THIS patent relates both to a peculiar form of rail-way, and to new methods of impelling carriages on them.

The new form of rail-way proposed is that of a tube, with a flat top, in which shape the patentee thinks they can sustain a greater load on the carriages than when of that commonly used. The new application of these tubular rail-ways, is intended by the patentee as pipes for the conveyance of water, either to give motion to machinery for domestic use, or for other purposes; and he expects that after having a sufficient supply to move water wheels, for giving motion to the carriages on the rail-way, by intervening machinery, he will have enough to spare for general purposes, to form a source of revenue, and so as even to work mills or manufactories to a large extent.

He also imagines that he will economise still further in the quantity of iron, by making the internal rails of double rail-roads broad enough for two wheels to pass at their opposite sides, by which means he can make three rails supply the place of four. To impel carriages on these rail-ways the patentee proposes two methods, in each of which a set of longitudinal revolving shafts are to be placed in the middle, between the two rail-roads, where they are used, or between the two rails in a single rail-road; and in the first case he designs to lodge these shafts inside the middle tube, arranged as above described.

These shafts (being turned round by the water-wheels before-mentioned, or by other power), by intervening toothed wheels fixed at regular intervals (of from 15 to 30 feet for example), give motion to axles or short shafts, placed at right angles to them, but so as not to obstruct the carriages; which axles in the first method proposed carry drum wheels, which support endless chains, arranged so that each chain passes over two drums, one of which sustains half of the preceding chain, by which means the chains at one side move all in one direction, while those at the other side pursue an opposite course, and thus afford means for impelling the carriages on the two different lines of rail-roads in opposite directions. It is plain that these drums may be placed so as to act either in a vertical or horizontal position, but that in the latter the chain would be more liable to slip off them, though it seems to be preferred by the patentee.

In the second mode of impelling the carriages, instead of drums, vertical toothed wheels are placed, with their planes parallel to the rails; and by one or more of the carriages a long rack is carried, placed so as to be acted on by two of those vertical wheels at the same time; so that when those wheels are all in motion, they will draw or impel the carriages successively, till the latter are driven entirely to the further extremity of the rail-road. The teeth of these wheels are described as being long, and placed far asunder, so as to resemble arms, while those of the rack, being of course made to correspond, will be like the rungs of a ladder, whose figure the rack will assume altogether, if constructed with double sides.

In a matter capable of being so beneficial to the public as rail-ways, we are glad to be informed of every contrivance of ingenious individuals at all applicable to them; for though many of them may be defective, others will be useful, and even those of the first description may tend to elicit serviceable ideas in others, as well as by their discussion to give more accuracy to opinions on this subject.

Where a longitudinal body is exposed to impulses on *every side*, we believe the tubular form will be the most economical, or that in which the smallest quantity of materials will afford the greatest strength. But where the impulses or pressure must be all at *one side*, another form will have the advantage, which has already, we believe, been determined by mathematicians. Mr. Wood, the author of a valuable treatise on rail-ways, lately published, says, that on account of the pressure moving over every part of the upper line of the rail between its supports, he would prefer the form of a semi-ellipse for its lower part to that of two semi-parabolas, usually considered the strongest, where the weight acts on the apex, or in the middle of the rail. Indeed it is evident at the first view, that if the same quantity of metal which constitutes a tube of six inches diameter, and half an inch in thickness, were formed into a parallelogram of the same length, and double the thickness, which would then be in depth about nine inches, and an inch in thickness, it would, when set edgewise, support a much greater weight than the tube before it would break, both being supported at their ends solely, as is usual in such experiments; and we may plainly perceive that it would sustain much more, if formed as Mr. Wood proposes, which would increase its extreme depth nearly three inches, without our having recourse to the well-known rule for ascertaining the strength by this addition (of multiplying the thickness by the square of the depth, and dividing the amount by the length), which latter being the same in both cases, would, at a rough estimate, show the strength of this form to be to that of the other as 144 to 81. To enter into minute calculations on this point, however, is neither suitable to our work, nor to the limits of this portion of it.

The plan of conveying water for turning mills for manufacturing purposes, through tubes of the diameter that a quantity of metal would afford, less than that of the common rails of rail-roads, as proposed by the patentee, if a serious one, and not the offspring of hasty unweighed thought, can only proceed from a mistaken notion, very prevalent we find among a certain class of inventors, that fluids can be forced through a given pipe with an infinite velocity; or, in other words, that they can make the fluid pass through it in any quantity in a limited time; on which idea we have known a worthy and ingenious gentleman take out a patent, some years ago, for an engine excelling a perpetual motion, as it was not only to keep itself going, but a large corn mill into the bargain. However this may be, it is well known that the quantity of fluid possible to be conveyed in a given time must depend on the size of the tube; and this being limited as mentioned, the supply can be by no means adequate to the purpose proposed; and we much doubt whether it could afford power even for impelling the carriages on the road to any considerable extent. In some, very few, situations those pipes might serve for conveying water for domestic purposes, breweries, and tan-yards, for the use of dyers and distillers, and other purposes of this sort; but for the reasons before stated, we cannot recommend the tubular form at all as a beneficial one for rail-ways.

The patentee is also mistaken in supposing that there would be any advantage in forming two rails into one, to sustain the load of two carriages, as proposed in his plan for making three rails serve the purposes of four, in two adjacent rail-roads; as it is evident that the rail in the middle must be made double the strength of two single ones, to support the load of two carriages in passing, and must also be double the breadth, to afford them room to pass, and therefore has no stuff to spare to increase its depth.

Of the plans for moving carriages on rail-ways, one very like the first proposed by the patentee has already been made the subject of a patent by Mr. R. Thompson, of Ayton Cottage. Some others mentioned by Mr. Wood resemble it also; but the plan of the patentee differs from them in having a succession of revolving shafts placed along the whole line for conveying the motion.

We cannot conceive what advantage would arise from placing these shafts within the tubes, as proposed, unless it might be to find some use for pipes that would otherwise be unoccupied: but passing by this matter, we will terminate our remarks on the specification of this patent by recommending the last method for moving carriages on rail-roads mentioned in it, as worthy of being the subject of experiment. In several instances where we have seen carriages moved on rail-roads by chains from stationary steam engines, so much friction and resistance appeared to be produced, by the chains dragging along the ground, which the rollers or sheaves over which they passed seemed to have little effect in preventing, that we have long thought some other better contrivance for effecting the same purpose was much wanted, and conceive that the plan of the patentee (where vertical wheels, moved by shafts, act on a long rack attached to the carriages,) promises to be so far superior, as it will have much less friction and wear of parts than the common method, and avoid its evident defects above-mentioned.

In one of the inclined planes which Mr. Wood mentions, on which carriages were moved by ropes from a fixed engine, the weight of the rope, that of the large wheel at the top, and that of the 73 sheaves over which it passed in a space of 715 yards, amounted altogether to 11,817 lbs. which would be 15·12 lbs. to the yard, or a little more than 15 lbs. which we should suppose would be a sufficient proportion for the strength of the shafts proposed by the patentee, if properly formed (in which respect the tubular shape that he so much admires might be used to good purpose), so as to produce an apparatus which, with little more weight of parts than that in use, would be free from its most conspicuous defects and chiefest inconveniences.

Patent granted to Mr. EDWARD JORDAN, *of Norwich, Engineer, for an improvement in the construction of water closets.* Dated March 27, 1824.

IN this water closet the seat is made to sink an inch or more on being pressed down, which depressing the short arm of a horizontal lever placed beneath, raises the opposite end of the longer arm, which causes a cock with three ways to turn a sixth part of a revolution, which being fixed in a pipe that leads from an upper reservoir of water into a cylindrical vessel containing air, admits the water into it, and causes the air to be compressed with a force proportioned to the height of the reservoir above it; another pipe branches off from the same cock, through which the water flows from the cylindrical vessel into the basin or pan, with an equal force, caused by the reaction of the compressed air; when the pressure being taken from the seat, admits the long arm of the lever to be depressed by a spring placed above it for that purpose, and the cock thereby to be turned back to its first position, which closes the communication between the reservoir and the cylindrical vessel, and opens that between the latter and the pan, in the cock with three ways.

The patentee states that the apparatus may be worked also by moving a handle, and mentions that when the height of the reservoir is not sufficient to compress the air in the cylindrical vessel, that this latter should be raised five feet above the seat, in order to act by the force of the fall of the water in descending.

The patentee seems perfectly conscious of the total want of novelty in every other part of this water closet, by his laying his claim in the specification particularly "to the introduction of the cock with three ways, in the manner and for the purpose explained."

Patent granted to THEODORE PAUL, *late of Geneva, but now of Charing Cross, for improvements in the method of generating steam, and in the application of it to various purposes. Communicated to him by a foreigner.* Dated May 13, 1824.

To produce steam of a high temperature the patentee, instead of a common boiler, uses a long metallic pipe, of small diameter, which is coiled round, with its coils a little asunder, so as to inclose a space inside of the form of the section of a cone, or other convenient shape, in which fuel can be placed for giving the pipe the heat required.

Into one end of this pipe water is to be driven by a small forcing pump, which, by passing through the pipe, when duly heated will come out at the other end, converted into highly compressed steam.

This is the general outline of the contrivance. For its particular application, though the patentee does not confine himself to any particular shape for the outline of the receptacle for the fuel, which the coils of his pipe are to produce, he however recommends two, of which he gives drawings. The outside of the first exhibits, by the disposition of its coils, somewhat of an ovoide form, obtruncated at its lower extremity, and contracted above in the place where the smoke is to pass upwards; and at the inside they are bent round so as to produce an elevated bottom, in the shape of a hollow cone, the base of which joins the lower part of the external portion, at a section of the ovoide figure, somewhat above the lowest of its foci.

The other figure in the drawings is in the form, externally, of an obtruncated cone, with the base turned upwards, and inside the coils produce the same elevated conical bottom as in that described, with its broadest part joining the lowest portion of the external part, in a similar manner. This latter shape is intended for the use of locomotive engines, as it will facilitate the introduction of fuel by its wide opening above, where it is to be thrown in. The other shape is intended for general purposes, and in it the fuel is either to be thrown into the upper part, where the smoke escapes, or the coils are to be arranged so as to leave an opening at the side for that purpose. In both methods the whole is to be surrounded outside by a plate iron case, which, to more perfectly confine the heat, should be double; or, in other words, a second case should be placed outside the first, and the space between the two should be filled with brick dust, coal ashes, or some other bad conductor of heat.

The bottom of the case, and of the coil-formed fuel-holder, rests on a flat metal ring, beneath which is a hollow cone of metal plate, with its base next the flat ring, which conveys the ashes from the fuel into a closed ash pit below.

The coals, or other fuel, are to be burned in the space between the elevated conical bottom and the external coil-formed receptacle, the conical bottom rising two-thirds of the height of the latter, to admit of its disposition in this manner. The air necessary for the fire is recommended to be introduced below into the conical ash tunnel, by the pressure of bellows, in preference to leaving the ash pit open.

The pipe is described as being made of copper, but the patentee states that it may be also made of other metals, particularizing platina, gold, and silver, for this purpose, rather unnecessarily, as their great cost must in general preclude their being thus applied. It should be noted that the external fuel receptacle, and its internal conical bottom, are both formed of one continued pipe, so that the water introduced may pass through the whole successively. The patentee advises its being admitted into the pipe at the top of the outside receptacle, when, from the disposition of the coils, it will descend spirally through them to the lowest part, over the flat annular support, after which it will rise circuitously through the coils of the conical bottom, and pass out at its apex into a pipe, which descends inside in the hollow part of this bottom, and from thence goes to the steam engine. The coils of the pipe in this conical bottom are placed sufficiently asunder to serve as a grate under and within the fuel, both for the admission of air, and the transmission of the ashes downwards: and the mode described, in which the water is to circulate through the coils of the pipe, is that which the patentee advises as best for gradually increasing its temperature to the highest pitch required.

To produce the steam necessary for an engine of a two-horse power, the patentee states that a pipe 150 feet long should be used; and that to sustain an internal pressure equal to 150 pounds on a square inch, it should, when made of copper, have its internal diameter not greater than three-sixteenths of an inch, while its thickness was one-sixteenth of an inch, (its largest diameter from out to out being thus five-sixteenths in extent). When it is made of another metal, its thickness must be varied accordingly.

The reservoir for the water, which is to be injected into the pipe, is represented as placed above the fire-place in the arrangement for stationary engines. In those which are to be used in carriages it must of course have a position more suitable to their circumstances.

When engines of greater power than that mentioned are to be supplied with steam, a number of pipes, disposed as described, either arranged so as to form several distinct fire-places, or all combined in a single one, may be used; the proportion of which must depend on the quantity of steam required. They may also be heated either by the immediate contact of burning fuel, by reflected, radiated, or combined heat, or by inflamed gases.

The size, shape, and arrangement of the coils of pipes may be also varied, provided they are continued without interruption from the extremity where the water is injected, to that where the steam passes off to the engine. The furnace may also be formed and constructed in several different modes, to produce the same effect; the patentee also states that the pipes may be luted or coated with fine clay, or other materials of a proper description, to protect them from too rapid corrosion by the elevated temperature which they are to encounter.

We have observed in the account of Mr. Burstal's patent in this Number, that great hopes were entertained of forming light boilers, or steam generators, by the principle used in the tubular ones here described, provided Mr. Perkins's patent improvement was added to them of confining the water in them by a valve, till it was required to be let off to the engine in a highly elastic state, or of steam strongly compressed, as otherwise we are convinced from experiments, which we have seen, that the steam formed at the lower end of the tubes, would blow most of the water out of the rest, and leave them nearly empty to the action of the fire. In the method proposed by the patentee, the valves of the engine would alone stop the tubes; but, long as the tubes are directed to be, we do not think their length alone would prevent water occasionally passing into the engine along with the steam, if the valve above-mentioned was not also used for confining the water in them till the proper moment of delivery.

Several patents have been obtained for tubular boilers. One was granted for this purpose to Mr. Cox Stephens, in 1805 (for which see Repertory of Arts, &c. second series, Vol. VII. p. 173), but of a different form and construction from the above. Mr. Woolf also used tubular boilers in some of his patent steam engines several years ago, but the tubes were of a much larger description than those of Mr. Paul, and arranged very differently. Mr. James Curdy, of New York, also obtained a patent for a species of tubular boiler or steam generator, in June, 1824; but the tube which he used, both in size and other respects, varied essentially from that of the present patent. Indeed, Mr. Paul does not introduce his patent steam-generator as his own invention, or as one entirely new, as he candidly states it to be the contrivance of M. M. Revou and Moulinie, who in 1813 obtained a *brevet d'invention* of 15 years for it in Paris.

In the present state of the invention, and as it regards the important object we have stated, we can only consider it as an experiment of which we have considerable expectations, and, from wishing it to succeed, have given the foregoing advice relative to its improvement. We also think the arrangement of the coils of pipe is far from being the best that might be used, on account of their depending too much on the lateral communication of heat for their increase of temperature, in which direction Count Rumford, many years since, proved that very little heat could be conveyed in comparison of that given from below upwards, by an equal quantity of combustibles. The using those fine tubes as bars to support fuel, is also injudicious, especially for our coals, which require the application of the poker so much, and are so liable to the species of fusion called "clinking," by either of which these small tubes would soon be destroyed. Instead of this we would recommend that iron pipes, sufficiently strong, should be employed for supporting the fuel, made to communicate with one another, like those in Mr. Chapman's furnace (for which he received a premium from the Society of Arts), described in our 46th vol., and that water should be drawn through those iron tubes from the reservoir by the forcing pump, before it was injected by it into the coils of the long copper pipe. And these latter would most probably have a better effect, if arranged above the fire-place in the form of a low oblong ovoidal dome, somewhat similar to the upper part of a reverberating furnace; and also if covered above by an arch of materials which slowly transmitted heat, than when disposed as directed by the patentee.

We have to add that water may also be prevented from being forced into the steam engine along with the steam, by using a small forcing pump to inject so minute a portion at each stroke, that the whole of it will be converted into steam in passing through the long red hot pipe, which method we believe it to be the intention of the patentee to use. But in this way most of the steam will be converted into hydrogen, subject to be exploded by frequent casualties; and the pipes also will be worn out much more rapidly than in the method above proposed.

Patent granted to James Neville, *of High-street, Southwark, Engineer, and to* William Busk, *of Broad-street, Esq. for improvements in propelling ships, boats, or other vessels, or floating bodies.* Dated September 16, 1824.

Two methods are described in the specification of this patent, for propelling vessels. In the first the vessel is sloped from the middle of its bottom upwards to the stern, a little above the level of the water, and this slope is inclosed by a vertical partition lengthwise at each side, leaving the space at the stern open. In the lower part of the inclosure thus formed, are placed three horizontal frames, extending its whole length, moveable by hinges at the ends next the middle of the boat, and arranged so as to move freely up and down within the inclosed wedge-formed space described. The middle one of these frames is twice the breadth of either of the two outer ones, and each of them is furnished with six square valves, all moveable on hinges at their fore ends, but managed so that the four of each set which are next the stern open downwards to a certain extent, while the other two of each, which are next the middle of the boat, open upwards. These valves are so constructed, that they do not open more than in an angle of 45 degrees with the frames; and the frames also are fixed so that they cannot move further upwards than to bring these valves to a horizontal position. A steam engine, placed inside the vessel, is to move these frames up and down by rods ascending from their hinder extremities, in such a manner that the middle frame always is moved in a reversed direction from the two outside ones. These frames with the valves are called paddles in the specification, and their intended mode of operation is to act obliquely on the water, in the nature of inclined planes, and by the reaction to impel the boat forwards. The intention of the two valves in each frame next the middle of the boat opening in a reversed direction from the rest, is to admit the water more quickly to replace that driven out by the action of the other valves of the paddles. The middle paddle is made twice the breadth of each of the others to balance their joint effect, and their moving in opposite directions, is in order to make the motion of the boat more steady.

The other method of moving vessels proposed, is by the supposed action of compressed air forced through a sort of trough at the bottom of the vessel, formed like the wedge-shaped inclosure of the lower part of the vessel first described (and sloped upwards from the middle of the vessel likewise, in a similar manner to the stern, where it is open also as that is), but which at the bottom is closed by a horizontal floor, which prevents the entrance of the water in that direction. A blowing cylinder, such as is used in some founderies, worked by a steam-engine inside the vessel, is to impel air into the extremity of this trough, which passing backwards to the stern, is there expelled into the sea; and the patentee supposes that by its being thus driven out in that direction, it will force the vessel forwards by the reaction of the water.

Of the first method for propelling vessels mentioned in this specification, we have to observe, that the action of inclined planes for this purpose was proposed so early as the year 1757, by the well-known Daniel Bernouilli; several other methods have since been published for their application to the same design, among which a very ingenious but complicated one was inserted in the 20th vol. of the Annales des Arts, a translation of which paper, containing also an account of Bernouilli's plan, with a page or two of observations, will be found in the Retrospect of Arts, &c. Vol. I. p. 243.

The action of inclined planes is that which nature uses in producing the rapid motion of fishes; and it is also used largely by the Chinese in impelling vessels, some of which are of a considerable size, in the simple application of it in skulling, they sometimes using very large oars for the purpose, worked by six or eight men together. Some of the South sea islanders apply it also in a singular manner for the same purpose in their double canoes, from a frame in the centre of which they let down their paddles in a vertical direction, and work them to and fro across the frame, with the blades alternately reversed in their angular position towards the course of the canoe.

The want of success of the more complicated methods, which have been tried for this purpose, appears to have arisen from their having frames, and other parts belonging to them, moving in the water, which had no direct action in impelling the vessels, and which, by their resistance in the water, retarded their progress. The parts also which really acted, or the inclined planes, were in general too large in proportion to the power with which they were moved, from which defect they moved the water by a churning action, instead of impelling the boat. As it is evident the plan of the patentees, for applying inclined planes to this purpose, has both these imperfections, it cannot be expected that it will have much power for the design intended.

The method proposed for impelling vessels by compressed air, which is the second mentioned in the specification of this patent, seems an imperfect imitation of one published in 1815, by Mr. J. W. Boswell, for the same purpose (for which see Repertory of Arts, Vol. xxvi. p. 271), in which compressed air was made to act upwards on an inclined plane (formed at the lower part of the vessel, next the stern), with a force equal to the weight of water that might be contained in the space which it occupied; or more precisely, with a force equal to the difference between the weight of a column of water, of the depth from the surface to the bottom of the space occupied by the air, and of the same base, and that of another column of the same depth and base, but composed partly of the compressed air, and partly of water, as will be found more particularly stated in the paper mentioned. The plan of the patentees has, indeed, an inclined plane, represented in the drawing of the trough or tube, into which the air is to be forced, the upper part of it being made in that form; but then the operation of the air on it as an inclined plane is entirely destroyed by the floor at the bottom of the trough, which prevents the pressure of the water from the bottom upwards on the air, and only admits it in a horizontal position from the stern, by which means the compressed air can only act from behind by the force with which it can be driven out there against the water, which, on account of its little specific gravity, and consequent very small momentum, will have but an extremely limited power to impel the vessel.

Patent granted to TIMOTHY BURSTALL, *formerly of Bankside, Southwark, but now of Leith, and to* JOHN HILL, *of Greenwich, now of Bath, Engineers, for a locomotive or steam carriage, for the conveyance of mails, passengers, and goods.* Dated February 3, 1825.

THE peculiar contrivances used in this engine are classed under three heads in the specification; one of which relates to the formation of the boiler, another to the mode of supplying it with water, and the third to the general construction of the machinery.

The boiler is divided by upright partitions into several shallow compartments, which open above into a low space between them and the top, which forms a steam-reservoir. The fire-place beneath has a flue that passes under each of these compartments in its way to the chimney. It is to be supplied with coals by a feeding machine, if the most perfect performance is desired, and is to have the air, which it will require, pressed into it by a blowing cylinder, which the patentees state will prevent the formation of dense smoke. The water is made to pass the boiler from a plate-iron reservoir, placed beneath the perch of the carriage, by two small air pumps, which force air into it, and by its pressure on the water cause it to rise through a copper tube into the boiler, round which the tube circulates through all the compartments, into each of which it has an opening for supplying it separately with water. The diameter of the air pumps is to be such as will cause them to make water pass equal to the consumption of the steam. They force the air in the first instance into a hollow metallic globe, placed above the water reservoir, in which there is a valve, pressed by a spring or weight, that permits such part of the air to escape as exceeds the quantity regulated by its pressure, and which of course is limited also by the height of the water in the boiler, though we think not expressly stated, by some of the methods in use for that purpose. The pressure is to be sufficient to confine the steam at a heat from 250° to 600°, Fahrenheit.

The water in the reservoir, and the coals in the receptacle for their supply, are to be replenished as wanted, at the stages where the carriage is to stop in its journey.

The boiler and furnace are suspended by horizontal springs behind the hind axle, from the frame-work of the carriage. The two working cylinders of the steam-engine are fixed before the axle, and act on it by two beams, which are put in motion by their piston rods, the other ends of which beams turn two cranks on the axle by the impelling rods which connect them; one of which cranks is at right angles to the other, to preserve the continued rotation of the axle, on the well-known principle practised in steam-boats. The piston rods are made to work perpendicularly by the parallel 'geer,' as it is called, commonly used for this purpose, and the valves of the engine are shifted as desired in some of the usual modes. The steam is conveyed from the top of the boiler to the working cylinders, by a copper tube of due dimensions, which is made to bend round so as to form an entire vertical ring before it enters them, which the patentees assert will prevent its being broken, or its joints from being made to leak by the jolting of the carriage.

The carriage could be impelled by the motion of the hind axle alone in roads nearly level, but when they are of a nature to require the fore axle being turned also by the engine, then a shaft, placed beneath the perch, communicates the motion to it from the hind axle by bevel toothed wheels, in the manner common for such motions, a due regard being had to the horizontal motion of this axle, necessary for the direction of the course of the carriage, which is provided for by having a horizontal wheel, moveable round the centre of the linch pin placed above it, which the communicating shaft turns first, and from which the motion is continued to the axle by a vertical wheel attached to the latter.

The mode of giving motion to the two axles described, of course implies that the naves of the wheels must be fixed to them; but there is a particularity in doing this, that requires further explanation.

One of the wheels on each axle is fastened to it by a wheel or disk, with projections at its side, which correspond with similar projections on the inside face of the nave; and which, being constructed so as to slide towards or from the nave on a square part of the axle, by the intervention of levers, permit the wheel to turn freely on the axis, independent of the motion of the latter, or again connect them so as to move together when required; the use of which is, to admit of the two wheels at one side moving at times faster than the other two; which will be necessary when the carriage is to turn round, or when it is to move on a circular part of the road.

The apparatus for effecting the purpose described is called a "clutch wheel" by the patentees, and resembles those used for similar purposes in mills, in several different combinations, well known to mechanists.

A contrivance for retarding or stopping the motion of the wheels, necessary in descending hills, is also added, which causes segments of circles to press with great force on the naves of the wheels, by the medium of levers, properly disposed, which communicate with a pedal placed beneath the feet of the conductor, under the seat in front, by pressing on which he can stop the wheels when he pleases. A second pedal, in the same place, connected in a similar manner with the coupling apparatus above described, enables him to join the wheels mentioned to the axles, or disengage them, as he thinks proper. By the handles of two rods, placed also convenient to the seat of the conductor, one of which rods passes to the throttle valve of the steam pipe, and the other to a cock in the water pipe, he can, as is required, regulate the supply of water and of steam, and by the latter power increase or diminish the motion of the carriage, or stop it altogether.

The conductor also directs the course of the carriage: for this purpose his seat is placed in front, before the front wheels, as the most convenient situation; and directly before him is fixed a horizontal steering wheel, similar to those used in ships, which by intermediate wheels acts on a toothed segment of a circle, fixed beneath to the frame of the carriage, whose axis is concentric with that of the linch pin; and by turning which steering wheel to the right or the left, the conductor can cause the carriage to move to either side, as is necessary.

The patentees also describe an index, which they have contrived, to be placed near the steering wheel, by looking at which the conductor can ascertain the exact angle to which he should turn round the wheel; but we apprehend this instrument, however ingenious, would not be much required in practice.

In the drawings which accompany this specification, the body of a coach for passengers is represented, placed as usual, between the two axles of the carriage, and having fore and hind boots, similar to those of stage conveyances; but the patentees state that this part may be altered according to the uses for which the carriage is intended; and may of course be made like the body of a waggon, if designed for carrying mercantile goods.

The hind wheels are represented of large dimensions, and both they and the fore wheels as being furnished with metallic naves. It is stated also in the specification, that the toothed wheels, which are used to communicate the motion of the hind axle to the fore axle, should be so proportioned in size to each other, that they may cause the fore wheels of the carriage to move as much quicker round than the hind wheels as their peripheries are less, in order to make them operate equally on the road, and keep pace with their long-spoked neighbours.

This steam carriage, though apparently designed for common roads, may also be used on rail-ways, in which case it is evident the steering apparatus might be omitted, as the vehicles are guided on them by mere simple contrivances.

The patentees seem to have taken great pains to render this steam carriage as perfect as the knowledge as yet acquired, relative to this mode of conveyance, would permit; and the evident improvement which it exhibits on some of its predecessors, gives great hopes that the desirable object of making steam carriages capable of moving effectually on common roads, will be attained at no distant period.

The great impediment to the application of steam carriages to common roads, is their enormous weight, which in few cases, yet made public, has been much less than eight tons; to which, if the usual load of goods put on an eight-horse waggon were added (to supply the place of stage waggons being one of the objects of the patentees), no common road yet made could support them. It would therefore be an object well worth that ingenuity which the patentees have shown in the construction of their steam carriage, to contrive means for lessening the weight of those vehicles in every possible way, as well as to pursue the plan already used on rail-ways, of having carriages for conveying the mercantile goods, or the passengers, quite distinct from that of the steam engine, which, for the latter purpose, would also be desirable for other obvious reasons; for, exclusive of the idea of danger, which sitting close to a caldron of boiling water, subject to be precipitated on them by an unlucky stone or rut in the road, might give to people otherwise not very timorous, the great heat of the furnace and boiler would be very objectionable, at least during the warm months. In this way the steam carriages would serve the purpose of horses to draw other carriages (which they so far resemble, that on the rail roads where they are used they are called, we are informed, *iron horses*, by the workmen); and for common roads this separation of the weight on separate carriages would be even much more necessary than for rail roads, on account of their being formed of materials so much less hard and durable. Among the methods proposed for making engines more light, that of using boilers constructed of small pipes seems very worthy of attention; several modes of which have been already made public; among the more recent of which, that for which Mr. Theodore Paul has lately obtained a patent (an account of which is inserted in our present Number), seems in some respects to deserve a preference; but requiring, in order to complete it, the addition of Mr. Perkins's patent principle, of confining the heated water in the pipes by a weighted valve, till the instant of its being let off to act on the piston of the engine in the form of steam; as the water without this would be blown totally out of the pipes by the steam formed in its lower extremities.

The method of forcing the water into the boiler by the pressure of air, in an engine where no condensation is required, which is the case in that of the patentees, can do no injury to the general effect, and may be of some service on the principle applied in M. Latour's air engine (for which see Nicholson's Phil. Jour. vol. XXIX, p. 175), who caused a wheel to revolve by the expansion which the air received in passing from cold water into that heated to the boiling point; and as some of the air pressed into the patentees' water reservoir will be absorbed by the water, and pass over with it into the boiler, it will so far have a similar effect. It is also probable that the air pumps will keep longer and better in order than small water forcing pumps, both from air having less action on metal, and not being so liable to carry along with it extraneous substances.

It having seemed evident to us, that the name "*low-motive* carriage," given to that of the patentees, in their specification, may have arisen from a mistake of the copying clerk, for the word *locomotive*, we have altered it accordingly in the title. It seems proper, however, to notice, that the name is written "*low-motive*" in the title, and through all parts of the specification, where it occurs in that document, as examined at the enrolment office.

Patent granted to JOSEPH APSDIN, *of Leeds, Bricklayer, for a method of making lime.* Dated June 7, 1825.

THIS method of making lime consists in taking the "puddle" or "powder" of roads made of limestone, and drying it by the application of fire or of steam, or by exposure to the air, properly spread out; and when thus prepared, in burning it in a lime-kiln, according to the common method for making lime. After which, the patentee asserts, it will be fit to be used as lime, both for making mortar, with a due addition of sand, and for agricultural purposes.

In districts where good limestone is sufficiently plenty to be employed in making roads, it is most probable that the use of the road stuff, proposed by the patentee, would be no great object in saving expence. On the other hand, where it was not plenty, or where it was to be fetched from a great distance, it would be too costly to be employed in making roads.

It appears also that it would be extremely difficult to burn this limestone powder in a kiln, on account of its not having sufficient spaces between its particles for the admission of air to the fuel, by which it would burn badly, if at all, and would soon be extinguished.

As to agricultural purposes, it is doubtful if the limestone powder would be improved by burning it into lime. We have been where limestone gravel, or finely powdered limestone, was found naturally in beds beneath the soil, and there used to very good purpose for improving ground in the manner in which marl is employed ; and it seems most probable, that the road stuff of limestone roads would be as good for manure as the limestone gravel, or indeed rather better, when it is considered how large a mixture of other species of manure there must be among it, from the passage of cattle, and the dropping of various matters on the roads from the loads carried over them.

Account of A Practical Treatise on Railroads, and interior communication in general, with experiments and tables of the comparative value of Canals and Railroads, by NICHOLAS WOOD, *Colliery Viewer.* 1 vol. 8vo. 314 pages.

Some Remarks on A Practical Treatise, by THOMAS TREDGOLD, *Civil Engineer, (on the same subject).* 1 vol. 8vo. 184 pages.

A few Observations on the pamphlets of Mr. H. R. PALMER *and Mr.* JOHN VALANCE, *on a Railway on a new principle, and on the expedience of sinking capital in Railways; and on locomotion by air drawn through an arched tunnel, &c.*

WE notice the above four treatises under one head, from their containing altogether most of the information which has yet been published respecting railroads, a subject at present of much public interest.

Mr. Tredgold's treatise must certainly be esteemed by far the most useful, from the great number of facts which he has collected, the perspicuous manner in which he has treated of them, and for the excellent tables which he has composed.

Indeed his work is of that masterly nature, that Mr. Wood might be thought somewhat indiscreet in publishing on the same subjects so soon after him; but of this he has altogether and well freed himself, having given valuable information on some points that had escaped the former author; corrected one of his very few errors, though a material one; added considerably to the number of facts and experiments on the same subjects, and increased the number of useful tables respecting them. His treatise may therefore be considered as a valuable appendix to that of Mr. Tredgold, clearly and cautiously composed, and in most respects well executed. Mr. Palmer and Mr. Valance being both patentees, and we having already given some observations on their plans in our Notices of New Patents, we should not notice their pamphlets here but for the reason before stated, and for the purpose of adding a very few words more respecting some other points contained in them, which have a bearing on the subjects treated of by the two preceding authors. Mr. Palmer's work indeed is more in the same line of the two first, as it contains a few valuable facts and experiments on the more perfect formation of railways, and carriages for them, and on the friction of wheels and axles, and contains a table of the comparative value of the force of a horse, at 2½ miles an hour, on six different railways; which, however, would have been much more satisfactory, had Mr. P. added to it a detail of the facts which led to the conclusions he has there inserted, and not confined the statement of his authorities to a single instance, but corroborated the evidence of the wonderful performance of his invention by some other testimony, in addition to his own assertion.

The chief error in Mr. Tredgold's treatise lies in his hasty condemnation of wrought iron rails, in which he has followed the opinions of Mr. Chapman, in his Report on the projected Railway between Newcastle and Carlisle. Mr. Wood takes the other side of this interesting question, in which he seems to have a decided superiority, both from the quotation he makes from the Report of Mr. G. Stephenson, of Newcastle, on the subject, and from the Reply to Mr. Chapman's Report, by Mr. Thompson, of Tindale Fell, averring that the malleable iron rails, which had been laid down there for sixteen years, had no appearance of lamination; and that the whole of the wrought iron which had been used there for that period, appeared to be very little worse; while the cast iron certainly was much worse, and subject to considerable breakage, although the rails of this metal are double the weight of those of the malleable iron. The waggons used on both those railways carried each a chaldron of Newcastle coals, or 53 cwt.

Mr. G. Stephenson's Report states, 1st, that wrought iron rails can be made cheaper than those of cast iron, from their requiring to be made only half the weight of the latter to afford the same security to carriages passing over them. 2d, That they admit of carriages moving with greater velocity on them, from their toughness rendering them less liable to fracture from a sudden impulse. 3d, They are more easily kept in order, one bar of them being as long as several of the others, and thereby extending over a proportionally greater number of the blocks or pedestals; by which also these latter assist in keeping each other in their proper positions, while the joints being fewer, will enable carriages to pass more smoothly over them. 4th, The malleable iron rails are more regular in their wear, and on the whole will last longer than those of cast iron. Mr. G. S. here pointedly denies that wrought iron exfoliates, or separates into laminæ, in that part of them which is exposed to the pressure of the wheels, contrary to the assertions of some engineers (including Mr. Tredgold and Mr. Chapman), Mr. S. having closely examined rails which had been in use many years, with a heavy tonnage passing over them, and in no part of them having seen any appearance of such exfoliations. 5th, Mr. S. asserts that malleable iron will bear a pressure without injury which will "crumble down" cast iron. 6th, Malleable iron rails wear more equally; for those of cast iron have an external crust, harder than the rest, and when this is worn through, the decay of the rest becomes very rapid. 7th, The effects of the atmosphere are not so different on the two sorts as to be of much moment, Mr. S. having observed no oxidation, or crusting to any extent, on malleable iron railways. Mr. S. here notices a fact not easily accounted for,—"that malleable iron rails, subject to continued motion by the passage of carriages over them, are much less liable to rust than bars of the same metal, either standing or lying near them without being used; the latter continually throwing off scales of oxidated iron, while the former are scarcely at all affected."

We think the contradiction in these opinions on this important point, may be accounted for without imagining any intentional misstatement or neglect at any side, by merely supposing that Mr. Chapman and Mr. Tredgold contemplated one species of malleable iron, while Mr. Thompson and Mr. Stephenson examined another sort; the kind of wrought iron manufactured from scrap iron having probably been that to which the two first-mentioned gentlemen alluded, while the two latter examined rails made of British bar iron, fresh from the furnace, in its first application from the ore. We have seen ship bolts, made at the Funtly Mills by rollers, from scrap iron, split in driving into a form resembling a bundle of wires, while we have seen specimens of the other sort much more subject to break than to bend or separate into filaments or laminæ. We have also seen very ancient iron palisades, swelled out by the action of the weather, and divided into numerous thin laminæ, like the leaves of a book; but have reason to think they were fabricated before the art of making wrought iron from the ore, by the use of coke from fossil coal, was practised here, having never seen an instance of bars of this latter fabric in a similar state. As far as our opinion then can be of use, it must be decidedly in favour of malleable iron rails.

Another matter in which it appears to us that Mr. Tredgold is mistaken, is in the great preference which he gives to large waggons with heavy loads, on railways, to those of a smaller size. Mr. T. on this occasion seems to have imbibed the old prejudice for voluminous and ponderous packages, evinced in those very imposing, but expensive road-grinding engines, the eight-horse waggons; which put the nation to more cost to repair the destruction which they cause to roads, than the amount of all their expence to their owners, much as that is. We believe Mr. T. would alter his opinion on this point, if he perused the strongly attested evidence in favour of single horse carts, in the Reports published in 1809, by the Committee of the House of Commons, on roads and wheel carriages; and if he saw how very adequate such carriages are in Scotland, where they seldom carry more than a ton weight, to all the purposes of a very extensive and multifarious commerce; or if he had known what has been done in this way, by carriages holding still less, in other countries. It is true that occasionally articles of extraordinary shape and dimensions will require conveyance on railways, as well as on other roads; but then it is obviously better to suit the carriages to the occasion, by combining two or more of them, so as to sustain the unusual load equally, than to lay down an expensive railway, of ponderous dimensions, for the accommodation of such casualties. The great and increasing extent of railways of a smaller species, with light carriages, in Wales, tends to confirm our opinions on this subject so much, that we are inclined to advocate the use of a still smaller sort, even what some gentlemen might think ridiculously small, carrying loads not exceeding ten hundred weight in the carriages, as the most economical, and which would yield the largest return of profit, at least where horses were used for the draft; but where locomotive engines are to be employed for this purpose, their present ponderous forms might indeed make stronger railroads expedient, and this we imagine to be the only case in which they would be necessary.

Mr. Tredgold has noticed Mr. Palmer's patent railway, of which we have given some account in our last Number. In recommending a species of it ten feet high on level ground, we think he does not much serve this speculation, since this form would greatly add to its expence, and to the liability to lateral derangement of the pillars, which are the most objectional points in the contrivance; and would moreover considerably increase the draft of the horses used with them, as the downward draft caused by this arrangement would not only add to the pressure of the load on the rail, but otherwise increase the difficulty, by the awkward, and indeed dangerous direction in which it would cause the collars to press on their necks. Iron railways of this latter description must be out of the question, nor indeed do we think any kind of them of this metal would be as cheap as the common edge rails, as explained in our last Number; but in some situations, where durability is not a prime object, a wooden railway of this sort might be advantageous, for which consideration they would be very suitable for Russia, America, and other countries where timber is cheap; and indeed if the pillars were made more durable by the method proposed in our notice of Mr. P.'s patent, of having their central parts at the level of the ground defended by cast iron sockets, with the farther addition of cast iron heads or caps, furnished with socket joints in a similar manner, the plate of iron at top made to overhang the wood a little to throw off the rain, and all the wood work well painted; such a railway might perhaps last long enough to pay very well in many places, even in this country.

In thus differing on two or three points from Mr. Tredgold, we by no means intend to derogate from the value of his work, in the respects which we have before mentioned; and as there will be doubtlessly more than one edition of so useful a publication, and as he cannot desire to confine its perusal to one class of readers, who are far from being numerous, we hope he will excuse our recommending him to separate his algebraical calculations from the text in the next edition, by placing them either in an appendix, or inserting them in the form of notes; an alteration which will much extend the usefulness of the work, and cause it to be read with pleasure by many who would not endure the labour of going through these difficult premises, though they might be well pleased to know the conclusion, a task by no means agreeable even to expert algebraists, whom we have reason to think seldom give themselves the trouble of reading calculations of this sort, where they have no intention themselves of writing on the same subject.

Mr. Wood has cautiously abstained from giving any opinion relative to the plans for rail-roads of an unusual construction; and has founded his conclusions respecting the superiority of the edge railways over tram rails on a very careful examination, and the collection of well proved facts; he much discountenances the exaggerated expectations that lately prevailed very generally, of the great velocity with which carriages could be moved on them by steam engines, in which opinion Mr. Tredgold coincides: he thinks railways and locomotive engines will hereafter receive great improvement, so as to be much more efficacious for the same expence; and points out some circumstances on this head which will probably much accelerate their alteration for the better. In comparing the relative value of canals and railways, among other excellent observations, he states, that when a velocity of four miles an hour is required, the conveyance by railways will have a decided superiority; but that at the rate of two miles an hour, more work can be done on canals; and concludes with recounting many particulars which give railways a decided superiority.

In a work so well executed in general, it is with some reluctance that we proceed to notice any defects; they are, however, but few, and are easily rectified.

We were surprised to perceive that a gentleman so well informed as Mr. Wood, should retain the old error of friction depending on the *extent* of surface of the bodies in contact. Desaguliers, in his lectures more than 90 years ago, had clearly proved the error of this idea, as have many writers before him, and all who treat of such subjects since. Yet Mr. Wood seems so impressed with this notion, that he repeatedly accounts for the greater friction produced on certain occasions, from the greater extent of rubbing surfaces under the same pressure; and this even after relating an experiment which ought to have proved to him his mistake, in which a waggon, with bearings on the axles four inches broad, required considerably less force to move it than those with brass bearings one inch and a half in breadth, carrying equal loads.

Some verbal errors we would also desire to correct, lest the example of a respectable author should add weight to a wrong use of words, which in many instances has already tended too much to impare the accuracy of our language. In the first place we object to his giving the appellation of a *diagram* (in p. 181) to the statement of the value of the circumstances on which the aggregate amount of power required to drag a body over a given space depends; *diagram* being a word which, both from its Greek derivation and its general application, denotes a geometrical figure, such as those in Euclid's Elements.

In the account of his dynometer he has named the weight appended to it a *pendulum*, which, as it performs no office similar to the regulating part of a clock, to which this word is appropriated, we think also should be corrected; for if this licence is allowed, we may talk of the pendulum of a bell when we mean the clapper, or that of a pump to denote the handle, both of which resemble a pendulum full as much as the weight of Mr. W.'s dynometer.

And lastly, we think his denominating the pressure of steam its *weight*, which he does repeatedly, as if the two words were synonymous terms, ought to be amended, since steam has its weight as well as any other substance, and in this respect ranks between atmospheric air and hydrogen gas.

Mr. Valance's pamphlet is to be recommended for the statement it contains of the comparative value of locomotive and stationary steam engines in impelling carriages; and if he estimates the latter at a higher rate than is done by Mr. Tredgold and Mr. Wood, it is to be recollected that in his computation he considers them as being unencumbered with the heavy friction of ropes or chains, drawn along for great distances, which the other two gentlemen were obliged to take into the account in their statements. Indeed it is probable that one of the circumstances in which railway conveyance will be most improved hereafter, will arise from employing better modes of communicating the impulse of stationary engines to carriages; for which purpose we have already another very ingenious method, besides that of Mr. Valance, proposed by Mr. James in the specification of his patent, of which we give an account in the present Number.

LIST OF NEW PATENTS.

Charles Friend, of Bell Lane, Spitalfields, Middlesex, sugar refiner, for improvements in the process of refining sugar.—Dated July 26, 1825.—Six months to enrol specification.

John Redhead, of Heworth, Durham, Gentleman, for improvements in machinery for propelling vessels of all descriptions, both in marine and inland navigation.—Dated July 26, 1825.—Two months to enrol specification.

John Edward Brooke, of Headingly, near Leeds, woollen manufacturer, and James Hargrave, of Kirkstall, of the same place, woollen manufacturer, for improvements in or additions to machinery used in scrubbing and carding wool, or other fibrous substances.—Dated July 26, 1825.—Six months to enrol specification.

David Oliver Richardson, kerseymere and cloth printer, and William Hirst, manufacturer, both of Leeds, for improvements in the process of printing or dyeing woollen and other fabrics.—Dated July 26, 1825. Six months to enrol specification.

James Kay, of Preston, Lancashire, cotton spinner, for machinery for preparing and spinning flax, hemp, and other fibrous substances, by power.—Dated July 26, 1825.—Six months to enrol specification.

Richard Witty, of Sculcoates, Yorkshire, civil engineer, for an improved chimney for Argand and other burners.—Dated July 30, 1825.—Six months to enrol specification.

Joel Lean, of Fishpond House, near Bristol, Gentleman, for a machine for effecting an alternating motion between bodies revolving about a common centre or axis of motion; also certain additional machinery or apparatus for applying the same to mechanical purposes.—Dated July 30, 1825.—Six months to enrol specification.

The Rev. William Barclay, of Auldeare, Nairnshire, for an improved instrument to determine angles of altitude or elevation, without the necessity of a view of horizon being obtained.—Dated July 30, 1825.—Two months to enrol specification.

Richard Badnall, the younger, of Leek, Staffordshire, silk manufacturer, for improvements in the manufacture of silk.—Dated July 30, 1825.—Six months to enrol specification.

Samuel Bagshaw, of Newcastle-under-line, Staffordshire, Gentleman, for a new method of manufacturing pipes for the conveyance of water and other fluids.—Dated August 8, 1825.—Two months to enrol specification.

George Charleton, of Maidenhead Court, Wapping, and William Walker, of New Grove, Mile-end Road, Stepney, master mariners, for improvements in the building or constructing of ships or other vessels.—Dated August 10, 1825.—Six months to enrol specification.

Samuel Lord, James Robinson, and John Forster, of Leeds, Yorkshire, copartners, merchants, and manufacturers, for improvements in machinery for and in the process of raising the pile on woollen cloths and other fabrics, and also in pressing the same.—Dated August 11, 1825. Two months to enrol specification.

William Hirst, Henry Hirst, and William Heycock, woollen cloth manufacturers, and Samuel Wilkinson, mechanic, of Leeds, Yorkshire, for an apparatus for preventing coaches, carriages, mails, and other vehicles, from overturning.—Dated August 11, 1825.—Six months to enrol specification.

John Stephen Langton, of Langton Juxta Partney, Lincolnshire, Esq. for an improved method of seasoning timber and other wood.—Dated August 11, 1825.—Six months to enrol specification.

Jacob Perkins, of Fleet-street, London, engineer, for improvements in the construction of bedsteads, sofas, and other similar articles. Communicated to him by a foreigner. Dated August 11, 1825.—Six months to enrol specification.

Henry Richardson Fanshaw, of Addle-street, London, silk embosser, for an improved apparatus for spinning, doubling and twisting, or throwing silk.—Dated August 12, 1825.—Six months to enrol specification.

James Butler, of No. 64, Commercial Road, Lambeth, Surrey, for a method of making coffins for the effectual prevention of bodies being removed therefrom, or taken therefrom, after interment.—Dated August 12, 1825. Two months to enrol specification.

Marc Larivière, now residing at No. 21, Frith-street, Soho, Middlesex, mechanicean, late of Geneva, in Switzerland, for a machine for perforating metal plates of gold, silver, tin, platina, brass, or copper, being applicable to all the purposes of sieves, hitherto employing either canvas, linen, or wire.—Dated August 15, 1825.—Two months to enrol specification.

Joseph Alexander Taylor, of Great St. Helen's, London, Gentleman, for a new polishing apparatus for household purposes.—Dated August 13, 1825.—Six months to enrol specification.

Charles Downing, of Bideford, Devonshire, Gentleman, for improvements in fowling-pieces and other fire-arms.—Dated August 15, 1825.—Two months to enrol specification.

Andrew Shoolbred, of Jermyn-street, St. James's, tailor, for improvements on, or a substitute for, back stays and braces for ladies and gentlemen, chiefly to prevent relaxation of the muscles.—Dated August 18, 1825.—Six months to enrol specification.

Philip Taylor, of the City Road, Middlesex, engineer, for improvements in making iron.—Dated August 18, 1825.—Six months to enrol specification.

Peter Williams, of Leeds, and James Ogle, of Holbeck, Yorkshire, cloth manufacturers, for improvements in fulling mills, or machinery for fulling and washing woollen cloths, or such other fabrics as may require the process of felting or fulling.—Dated August 20, 1825.—Six months to enrol specification.

THE
REPERTORY
OF
PATENT INVENTIONS, &c.

No. IV. OCTOBER, 1825.

Specification of the Patent granted to Thomas Hopper, *of Reading, in the county of Berks, Esq. for certain improvements in the manufacture of silk hats.* Dated November 20, 1823.

TO all to whom these presents shall come, &c. *Now know ye,* that in compliance with the said proviso, I, the said Thomas Hopper, do hereby declare that the nature of my said invention, and the manner in which the same is to be performed, are particularly described and ascertained in the following description thereof, (that is to say):—*Method of manufacturing the New Patent Silk Hats.*—The woollen substance which forms the basis, is first to be boiled in a solution of the supersulphate of alumine and potass (common alum) for about two hours, in the proportion of two or three pounds of alum to a gallon of water. It is then to be taken out, well rinsed in clear water, and wrung, and immediately dipped in a solution of isinglass or glue, of variable strength, at a boiling heat, and put on a frame to dry, and give it a shape. The cloth thus prepared, and before, or when it becomes quite dry, may be again immersed in a strong solution of acetate or tartrate of alumine, (the acetate thus made,—alum about three pounds, sugar of lead one pound, dissolved separately in a gallon of water, and then mixed and decanted:—the tartrate thus made,—dissolve about two pounds and a half of alum, and one pound and a half of cream of tartar, in a gallon of boiling water; this need not be strained) or supersulphate, and allowed to remain in the liquor for a few hours; it may then be rinsed and dried as before. This liquor must not be hot. A third method is, to dip the cloth (previously alumed) in a solution of gelatin, and one of the aluminous salts, added together; when wrung, immerse it once or twice in an alkaline lixivium; afterwards dry as before. By these processes the gelatin is set or fixed in what may be termed the first, second, and third degree, and the manufacturer may use the first singly, or combined with the second, as directed, or the third only. In the last process, a double chemical change is effected; the acid of the aluminous salt leaves it, and attaches itself to the alkali, while its base, the alumine, combines with the gelatin, 'renders it insoluble in water, and together with it remains affixed to the cloth. Various important advantages appear to be derived from the alumining process. It effectually removes the grease from the wool, by which, conjoined with its strong affinity for the cloth and gelatin, between which there exists but little naturally, it acts as a powerful intermedium in fixing the latter,—enables it to resist the action of water, from the absorption of which, when used in its simple state, and consequent increase of volume, appears to rise one of the principal causes of the disjunction and falling to power of the resinous gums. It prevents the cloth from shrinking in any sensible degree, when subsequently wetted; facilitates the adhesion of the gums with the wool; and serves to equipoise those materials that are fusible by heat. The resinous gums may now be applied in the same manner as at present practised, or they may be used in the humid way, dissolved in a spirituous menstruum, with a proportion of Venice turpentine. It is usual to mix a third or fourth part of resin or sandarack with the lac; but the mastiche is preferable, not curling up in cooling like the sandarack, and possessing more tenacity than either. It contains a substance analagous to caoutchouc. Caoutchouc, or elastic gum, dissolved in rectified oil of turpentine, and rendered drying by pure alumine, by washed æther, or which is more economical, as much acetate of alumine as it will absorb; they should be rubbed together. It is intended for the rim, but a discretion is left with the manufacturer in its application. Between the resinous gums and the varnish, an intervening substance, not fusible by heat, is necessary to prevent the latter from subsiding. Isinglass dissolved in weak spirits, gum acacia, simple or pure aluminous paste, &c. suffice; the pure alumine is also used inside, mixed with common or resinous paste; pure alumine is obtained by pouring on a solution of alum, a solution of potass, soda, or ammonia, washing the precipitated powder once or twice with boiling water, and after filtering, drying the powder. The varnish, either that in common use, or the following, may be employed—asphaltum four parts, gum mastiche or amini two or three parts, drying linseed oil from two to three parts; melt the bitumen and gum in an iron vessel over a charcoal fire, then add the oil; when well mixed, remove the vessel from the fire, add Venice turpentine two parts, and, gradually, six or eight parts of essential oil. Strain; if it should be too thick, when cool add more of the essential oil. The proportions here given, admit of being varied.

In witness whereof, &c.

Note. The preceding specification has been carefully compared with the record in the Enrolment Office, of which it is a correct copy.

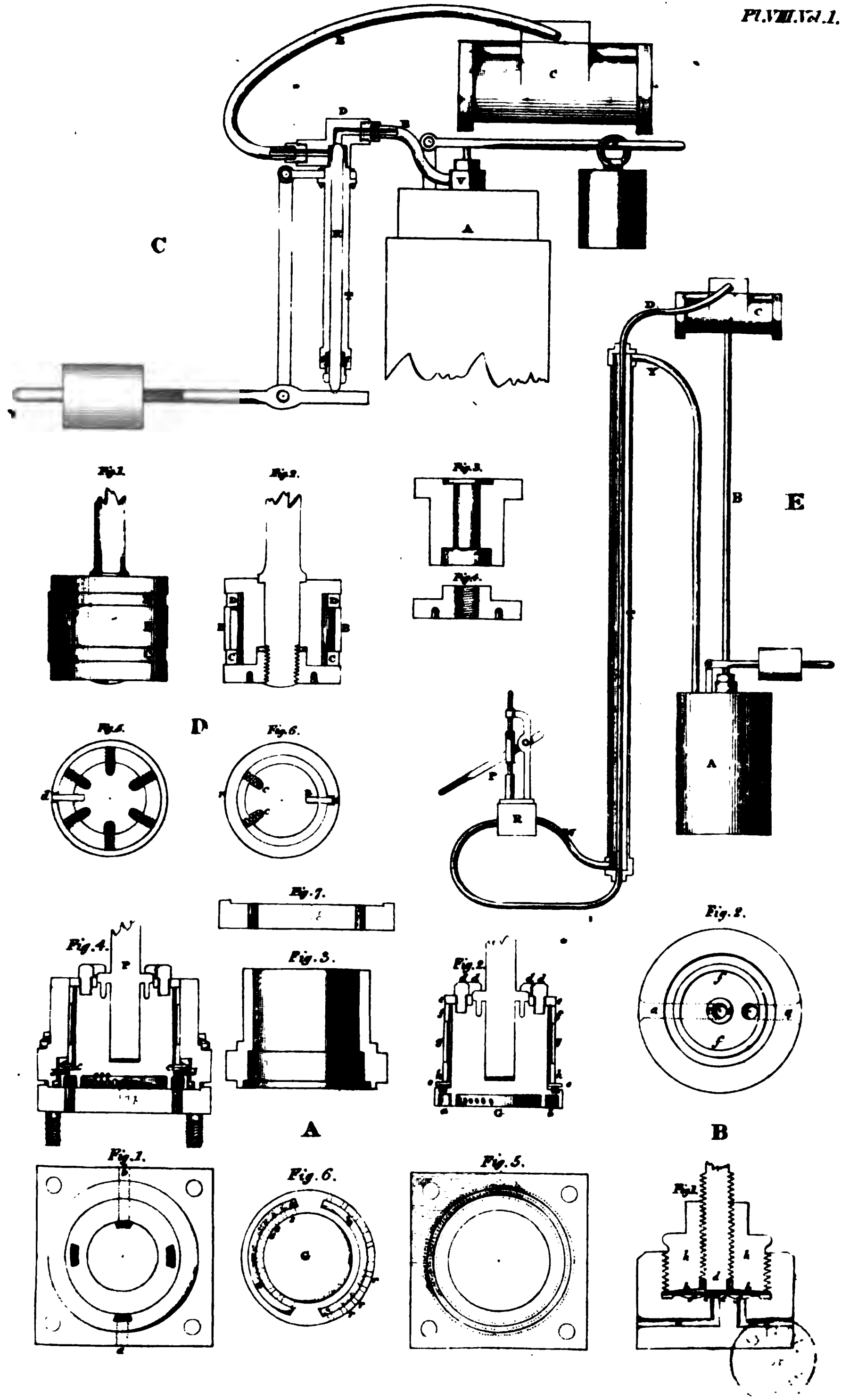
Specification of the Patent granted to Jacob Perkins, *late of Philadelphia, in the United States of America, but now of Fleet-street, in the city of London, Engineer, for certain improvements in steam engines, in part communicated to him by a foreigner residing abroad.* Dated June 5, 1823.

WITH A PLATE.

TO all to whom these presents shall come, &c. &c. *Now know ye,* that in compliance with the said proviso, I, the said Jacob Perkins, do hereby declare my said improvements to consist, First, of an improved rotary valve; Second, of a new valve to serve as a throttle valve; Third, of a new application of a loaded valve; Fourth, of a new arrangement of rings for metallic stuffing; Fifth, of a new condensing apparatus. And that the nature of my said first improvement of an improved rotary valve doth consist in reducing the friction caused by the action of the steam on the upper surface of the revolving plate now in use in rotary valves, by substituting a revolving plug in lieu thereof, and opening the upper surface of such a plug to the atmosphere. It should here be stated that when I say the upper surface of the plate or plug, I suppose the valve to be in a horizontal position. And that the nature of my second improvement, of a new valve to serve as a throttle valve, doth consist in opening and closing the passages for the steam, by means of the elasticity of a metallic plate, acted upon indirectly by the governor. And that the nature of my said third improvement, of a new application of a loaded valve, doth consist in creating pressure upon the steam generated for the purposes of the engine, which pressure must be overcome by such steam itself, before such steam can act upon the piston or reach the cylinder. And that the nature of my said fourth improvement, of a new arrangement of rings for metallic stuffing, doth consist in keeping the expanding opening of the flexible ring steam tight, by means of eccentric and non-expanding rings. And that the nature of my said fifth improvement, of a new condensing apparatus, doth consist in condensing the steam in the eduction pipe, as it leaves the cylinder, by forcing the supply water, cold or at a low temperature, round, and along a considerable surface of the said eduction pipe, in such manner as to keep such supply water always under pressure. And in further compliance with the said proviso, I, the said Jacob Perkins, do hereby describe the manner in which my said several improvements are to be performed, by the following descriptions thereof, reference being had to the drawings and figures annexed, that is to say:—As regards my said first improvement, of a new rotary valve, it is described by the drawing marked A, (Pl. VIII). Fig. 1 is a plan of the main or fixed plate of a rotary valve now in use; *a* representing the situation of the induction, and *b* the situation of the eduction pipe; and *c*, *e*, the channels leading into and out of the cylinder. Figure 2 is a section of my improvement, which I substitute for the revolving plate now in use, and is in fact a revolving plug, furnished with my improved metallic stuffing, hereinafter more particularly described: *f*, *g*, *h*, are the three rings of the said metallic stuffing, and are kept up to the rim, *e e*, at the top of the plug, by means of the support ring, *c c*, which is acted upon by the spiral spring shown under it: *d*, *d*, *d*, *d*, are screws to fasten down the collar, *e e*: *a*, *b*, are two channels for the steam, which by the rotary motion of the plug are opened alternately to those openings shown in figure 1, at *c* and *e*. One of the principal properties of this plug is, that by its peculiar construction, the steam which in the revolving plate now in use presses wholly on the upper surface, and thus creates an increased friction, according to the force of the steam, is allowed in my improved valve to pass from the induction pipe round the outside of the plug, filling the space, J J, figure 4; from this space it finds its way through the holes at *r*, through the passage, *b*, into the passage, C, and so into the cylinder.

Having performed its duty in the cylinder, the steam passes out of the cylinder by the passage, *e*, into the passage, *a*, and thence through the holes, *s s s*, into the chamber, G, whence it escapes into the eduction pipe, *b*. Figure 6 is a plan of the under surface of the said plug; *a*, *b*, are the two passages for the steam, and it will be seen that the passage, *a*, communicates with the centre space or circular chamber, G, by means of holes, *s s s*, and that the outside of the plug communicates with the passage, *b*, by means of holes at *r*, *r*, *r*. By this arrangement it will be seen that the steam in the chamber, *a*, and the chamber, G, will be pressing the plug upwards, while the steam that is suffered to enter into the space, J, figure 4, on its way into the passage, *b*, passes round the outside of the plug, but is still confined in the outer casing of the plug, and will therefore press the plug downwards, by acting on that part of the plug immediately under the support ring, *c c*, in an equal proportion, or nearly so, as the steam in the chamber, G, and passage, *a*, is pressing it upwards, thus destroying or rather neutralizing the excess of friction which would otherwise be created by an increase of force in the steam. The plug receives its rotary movement through the medium of the shaft, P, which is furnished with a cogged wheel or other apparatus for that purpose. Figure 5 is a plan of figure 3, and figure 7 is a section of figure 1, and figure 3 is a section of the outer casing of the plug or stuffing box, shown by itself; and the outer casing or stuffing box being open at its upper surface, it will seem that the upper surface of the revolving plug, passing through and above it, is of course open to the atmosphere, and subject therefore to the pressure of atmospheric air only, and not of steam, as is the case in the upper surface of the revolving plate now in use in rotary valves. And as regards my said second improvement of a new valve, to serve as a throttle valve, it is described by the drawing marked B. Figure 1 is a section of the said valve: *d* is a screw acted upon by the governor, and working in the screw plug, *h h*, the bottom of which plug it will be observed is concave: *b b* is a thin flexible plate of steel or other metal, acted upon by the end of the screw, *d*, which action presses the steel plate so tightly down upon the flat surface, *e e*, that no steam can escape from the passage, *a*, while it remains in this position. When the action of this screw is removed from the plate, *b b*, it rises from the flat position which it assumes in this figure up into the concavity at the bottom of the screw plug: *a*, *q*, are passages connected with the steam pipe, and *f f* is a circular communication passage, by which the passage, *q*, is fed, when the steel plate, *b b*, rises. By this arrangement it will be seen that in the position which the steel plate, *b b*, is represented in this figure to assume, all communication is stopped between the passages *a* and *q*; but if the screw, d, were raised, the steel plate, *b b*, would immediately rise by the under action of the steam, and a communication would be at once formed between passages *a* and *q*, by means of the circular passage, *f f*. Fig. 2 is a sectional plan of part of my said second improvement, showing more clearly the relative situations of the passages *a* and *q*, and *f f*. And as regards my said third improvement, of a new application of a loaded valve, it is described in the drawing marked C. In this drawing A represents a patent generator, with its loaded valve, V, and B B the steam pipe communicating with such valve at one end, and with the cylinder, C, at the other end; at D in the steam pipe is a loaded valve, the nature of which is sufficiently explained by the drawing, except that it is necessary to state that the rod or plunger, R, fits sufficiently loosely in the tube, T, to allow of water rising round it in the tube to its upper extremity, or nearly so. This water being pressed upon by the steam above it, will keep the leather or other collar at *e e*, tight or close round the lower extremity of the rod R, which is so long as to prevent the water getting sufficiently heated to destroy the leather. It will be seen by this arrangement that the steam generated by the generator before it can pass into the cylinder, must force open the loaded valve at D by its own power, and cause thus pressure upon or interruption of the steam, previous to its entering the cylinder, being in fact the substance of my said third improvement; it will be proper here to state that the application of a loaded valve, interposed between the steam chamber of an ordinary steam boiler and the cylinder, will answer the same purpose; my said third improvement, therefore, does not embrace any novelty that may be in the particular loaded valve described in the said drawing marked C. And as regards my said fourth improvement, of a new arrangement of rings for a metallic stuffing, it is described by the drawing marked D. Fig. 1 is an elevation of a piston, with my improved metallic stuffing; B being the flexible expanding ring now used for metallic stuffing, and C, D, the two inflexible and non expanding rings, which constitute my said fourth improvement. Fig. 2 is a section of fig. 1, and figs. 3 and 4 are sections of the different parts of the piston head, shown separately. Fig. 5 is a plan of the flexible expanding ring now in use for metallic stuffing. By an examination of this ring it will be seen that there is an opening at *d*, and to prevent the escape of steam at this opening, I place the two rings marked C, D, in fig. 1, one on each side of the flexible ring. Fig. 6 is a plan of one of the said two rings, which will be sufficient to explain, as they are both alike: N is a guide pin, on which the notch cut in the ring at *e* moves loosely: C, C, are two spiral springs, which press the side of the ring to which they are attached, *r*, eccentrically from the piston. When these two rings are fitted on the piston, the part, *r*, should be arranged to come directly over the open part, *d*, of the flexible expanding ring; and it will be seen by this arrangement, that when the piston is put into the cylinder, these two eccentric rings, C and D, fig. 1, will press against that part of the cylinder immediately above and

Pl.VIII. Vol.1.


C
A
C
D
E
V
E
B
A
C
D
Y
P
R
Fig.1.
Fig.2.
Fig.3.
Fig.4.
B
B
C
C
D
D
Fig.5.
D
Fig.6.
Fig.7.
Fig.4.
P
Fig.3.
Fig.2.
G
Fig.8.
f
f
a
a
A
B
Fig.1.
Fig.6.
G
Fig.5.
Fig.1.
h
h
d
a

below the opening in the elastic ring, B, and will thereby supply the deficiency occasioned in the piston by such opening in the elastic ring; and reversing the action of the parts above described, the same may be equally well applied as a stuffing for the piston rod. And as regards my said fifth improvement, of a new condensing apparatus, it is described in the drawing marked E. In this drawing, A is a patent generator or steam boiler, with its loaded valve: B is an induction pipe, leading from the patent generator to C, which is supposed to be the cylinder: D is an eduction pipe which passes through the tube, T, and thence into a reservoir or well, R. This reservoir or well feeds the forcing pump, P. The pipe marked W is a pipe leading from the forcing pump into the tube, T, and the pipe marked Y, being a continuance of W and T, is the supply pipe to feed the said patent generator. With this apparatus the operation of condensing is performed, in the following manner, (that is to say):—The steam generated by the said patent generator, passes by the induction pipe, B, into the cylinder, C, at a very high temperature, and leaves the cylinder after having performed its duties there, at nearly the same temperature, by the eduction pipe, D. While the steam is passing through the part of the pipe which is encircled by the tube, T, cold water from the reservoir or well, R, is pumped through the tube in a contrary direction, by means of the forcing pump, P. The effect of this operation will be, that the steam in the eduction pipe will be condensed, and will run in the form of water into the well or reservoir, R, while the cold water, by passing through the tube, T, becomes heated, and in that state passes out of the tube, T, by the pipe, Y, and thence into the said patent generator. Now whereas I do not claim to be entitled to exclusive privilege to any such parts of machinery or apparatus as are described in my several descriptions of the drawings hereunto annexed, to be now in use, nor to the said generator and loaded valve, therein described to be patent; but a rotary valve, so improved as aforesaid;

and also a valve to serve as a throttle valve, on the principle aforesaid; and also my said new application of a loaded valve, constituting an apparatus for the purpose of creating pressure on the steam generated for the purposes of the engine, which pressure must be overcome by such steam itself before such steam can act upon the cylinder, or reach the piston; and also an arrangement of rings for metallic stuffing, on the principle aforesaid; and also a condensing apparatus, on the principle aforesaid; being every and each of them, to the best of my knowledge and belief, entirely new, and never before used in these kingdoms, nor in any of His Majesty's colonies or plantations abroad. I do hereby declare this to be my specification of the same, and that I do verily believe this my said specification doth in all respects fully, and without reserve or disguise, comply with the said proviso, in the said in part recited letters patent contained; and I do therefore hereby propose to maintain my exclusive right and privilege to the same.

In witness whereof, &c.

Specification of the Patent granted to DAVID GORDON, *of Edinburgh, at present residing at Stranraer, Esquire, for certain improvements in the construction of harness for animals of draft and burthen.* Dated September 8, 1821.

TO all to whom these presents shall come, &c. &c. *Now know ye*, that in compliance with the said proviso, I, the said David Gordon, do hereby declare that the nature of my said invention, and the manner in which the same is to be performed, are particularly described and ascertained in the following description thereof, (that is to say):—My improvements consist in the application of helical or screw-like springs, fitted up in iron or other metallic or unyielding tubes, somewhat in the manner of spring steel-yards, to those parts of harness termed traces, hame tugs, pole pieces, backbands, or breechings; and they may either be inclosed within the leathers forming those parts of the harness, or not, as may suit the fancies of the persons using them. If in the long traces, used in drawing stage coaches, gentlemen's carriages, curricles, gigs, &c. I place the springs far enough behind the horses, so as not to rub against their sides. When the horses draw by what are commonly called hame tugs or earing chains, the springs should be placed close to the hames; and this is particularly necessary to be attended to, when two or more horses are drawing in one line, so that the draught of one horse only should act upon one set of springs. I do not intend hereby to confine myself to any particular strength of the springs, but I recommend that each trace should have a spring or springs attached to it, capable of drawing from one to two hundred pounds weight, the utmost power of a horse being, I believe, less than equal to four hundred pounds. The advantages I propose from the employment of these springs in the traces are, the facilitating the draught, and the preventing of sudden checks or jerks, and thereby avoiding shaking or galling the shoulders of the horses, and also contributing to the ease and comfort of the passengers; and when added to the breechings or pole pieces of harness in general, they also afford a farther relief to the horses.

In witness whereof, &c.

Specification of the Patent granted to PIERRE JEAN BAPTISTE VICTOR GOSSET, *of Clerkenwell Green, Middlesex, Merchant, for certain improvements in the construction of looms or machinery for weaving various sorts of cloths or fabrics.* Dated December 18, 1824.

WITH AN ENGRAVING.

TO all to whom these presents shall come, &c. &c. *Now know ye,* that in compliance with the said proviso, I, the said Pierre Jean Baptiste Victor Gosset, do hereby declare the nature of my said invention by the following description thereof, and the manner in which the same is to be performed and carried into effect, by the drawing which is hereunto annexed, reference being thereunto had, and to the figures and letters marked thereon as follows, (that is to say):—My said improvements relate to that part of looms or weaving machinery which is usually denominated the shuttle, being the implement or apparatus which contains the yarn or material employed to form the woof or weft of the cloth or fabric.

In shuttles such as are at present known and in use, great difficulties have been experienced in causing the thread or yarn to come off the bobbin or shuttle cap with a uniform tension, without which it is almost impossible to produce a good and even cloth; but by my improved form and construction of shuttle, and disposition of the bobbin therein, I am enabled to apply a regulating spring, for the purpose of creating the necessary resistance upon the bobbin, which said spring is furnished with an adjusting screw, by which the power of the spring may be increased or diminished at pleasure, thereby insuring a proper degree of tension upon the yarn at all times. Fig. 1 (Pl. IX.) upon the annexed drawing represents a plan of a shuttle, constructed according to my improvements. Fig. 2 represents an edge section, and fig. 3 a transverse section, supposed to be taken near the middle thereof. This form of shuttle is particularly adapted to the weaving of cloths, or fabrics composed of metallic wire, or other stiff and unelastic materials. A A represent the body of the shuttle; it may be formed of wood or other suitable material, and tipped or pointed at its extremities with metal, in the ordinary manner: B B show the opening which is made in the side thereof, in order to receive the bobbin or weft roller, C, which is formed with flanges in the manner of a pulley, and is adapted to turn correctly upon a pin or wire, *a*, which said pin passes through the top and bottom of the shuttle; by withdrawing the pin, *a*, the bobbin may be taken out and replaced again with great facility: D D represent the regulating spring: it is formed of steel or other sufficiently elastic material, and is affixed to the shuttle at each of its extremities, by being turned down and driven into the wood, or it may be fixed to the shuttle in any other convenient manner.

This regulating spring is shown separately upon a larger scale at fig. 4 upon the drawing; it is furnished with a second or small curved spring, at *d*, which is adapted to bear and press upon the upper surface of the bobbin, as will appear evident from inspection of fig. 2: *e* shows a small adjusting screw, the head of which is intended to be inserted or sunk into the upper part of the regulating spring, D D, in order to prevent its becoming entangled with the threads or yarns of the warp in its passage across the same during the act of weaving. The lower extremity of the adjusting screw is adapted to work into a small nut or female screw, *h*, which is supposed to be firmly fixed into the wood forming the shuttle, so that by turning the said screw round the part, *d*, of the regulating spring, may be caused to press with more or less force upon the upper surface of the bobbin, and thereby create a greater or less degree of resistance for regulating the tension at which the yarn or thread shall be drawn off the circumference of the bobbin, and through the eye, *c*, of the shuttle. I generally line that part of the shuttle upon which the bobbin rests with a plate of metal or other substance, having an even surface, in order that the resistance against the under surface of the bobbin may vary as little as possible.

It will appear from inspection of fig. 3, that the upper and lower surfaces of the shuttle are formed concave, in order that the head of the adjusting screw, *e*, of the regulating spring, D D, may not project so as to injure or entangle the yarns of the warp during the passage of the shuttle; and in some cases I find it convenient to place the spring within the opening, B B, of the shuttle, leaving a small round hole in the upper part thereof, for the purpose of introducing a turn screw or instrument to the end of the adjusting screw, when it is required to increase or diminish the power or resistance of the regulating spring upon the bobbin.

In some constructions of shuttles it will be found advisable to have no opening in the edge of the shuttle. This I effect by forming the shuttle like a box, with a lid sliding in grooves or otherwise hinged on, being provided with a catch or fastening, so that the said lid may be opened or removed when it is desired to take out the bobbin and replace it by another. In this construction the regulating spring, with its adjusting screw, may either be fixed upon the said lid, or it may be situated in the opposite or fixed side of the shuttle.

In weaving articles of stiff wire, with my improved shuttles, I find it advisable to employ a casing or tube of some elastic substance, to surround the bobbin, as seen by dotted lines in fig. 2. This tube is not quite entire, but has an opening or slit down the side thereof, for the wire to pass through; and by closely encompassing or embracing the bobbin at every part except the slit, it prevents the coil of wire upon the circumference of the bobbin from unwinding or recoiling, and becoming loose or entangled, and allows it to be drawn off evenly or regularly, in proportion as it may be required to form the cloth or fabric; and when the metallic wire desired to be woven is stiff and hard, I occasionally employ a small pair of tempered steel rollers in the side of the shuttle, at about the place where the small eyes, *c*, are represented, by which means the wire runs out with considerably less friction. Figs. 5 and 6 represent another description of shuttle, constructed according to my improvement. This form of shuttle would be applicable to the weaving of cloths, or fabrics of silk, or any other material: A A show the body of the shuttle; it is hollowed out from the edge at B B, as above described, with reference to the former figures. This shuttle is provided with three separate bobbins or pulleys, to contain thread or yarn, as seen at c c c, which bobbins may either be worked one after the other with the same coloured yarn, or other different coloured yarn may be wound upon each of the bobbins for weaving figured goods. Thus, when a change of colour in the weft is required, it will be only necessary to break off the end of the yarn which was done with, and suck or draw the end of the other colour through its respective opening or eye, as seen at *c c c*. These bobbins are supposed to be constructed like pulleys, with two broad rims or flanges, in the same manner as above described, and to be each provided with its regulating springs, D, and adjusting screw, *e*, in order to regulate the tension at which the yarn should come off from the circumference thereof. The springs, D, are represented in figs. 5 and 6 as fixed to the shuttle by one of their extremities only; but they might be affixed at each extremity, and made to bear upon the bobbins by a small curved spring, as hereinbefore described. When the regulating springs are fixed, as shown in figs. 5 and 6, I generally turn the loose end, or that end which bears upon the bobbins slightly downwards, and allow it to enter beneath the surface of the wood forming the shuttle, by which means the extremity of the spring is effectually prevented from becoming entangled with the yarns of the warp, in its passage across the same.

It is not essential that three bobbins only should be used in one shuttle; but a greater or less number may be employed, as circumstances require.

I have now described with reference to the annexed drawing, my said invention for improvements in shuttles, which form part of a loom or machinery for weaving various sorts of cloths or fabrics; and I hereby declare that my invention consists in the peculiar form and construction of shuttles for weaving, which I have hereinbefore described, and are represented in the figures upon the annexed drawing; the said peculiarity in construction being that the bobbin upon which the thread or yarn is wound is made in the form of a wheel or pulley, and is situated and placed upon a pin or axis, which said axis or pin remains in a vertical position when the shuttle is in use, instead of the thread or yarn being wound upon a small bobbin or roller, situated upon an horizontal axis in the ordinary manner. Another of the improvements which I claim as new in these shuttles, consists of the regulating spring, marked D D, in the figures, as operated upon, or regulated in its force by the adjusting screw, marked *e*, for the purpose of adjusting or regulating the tension of the yarn in passing off the circumference of the bobbins. At the same time I wish it to be understood, that I do not claim the general use of springs, as applied in shuttles for weaving, but only for the particular manner of applying them, and providing them with a regulating or adjusting screw, herein efore described and set forth.

In witness whereof, &c.

OBSERVATIONS BY THE PATENTEE.

By this invention all sorts of woollen goods can be made in the most complete manner, uniting both beauty and strength, and without any difference of quality to be found through all the piece, of whatsoever it be manufactured; which cannot be asserted of any of those made in the usual way, since the stretching of the wool has always caused in them irregularity and defects, very offensive to the eye, such as clear places, shrinkings, &c.

We cannot be astonished at the impossibility hitherto found of manufacturing any thing in a perfect manner, since the warp is either stretched, or the shoot irregular. This is so true, that when the manufacturers desire to have any thing woven carefully, they have it done by the hand shuttle, which obliges the workmen to spend a great deal of time in completing their work, because they are obliged frequently to straighten the threads of the shoot; and it often happening that they are not arranged like the first,

Fig 8.

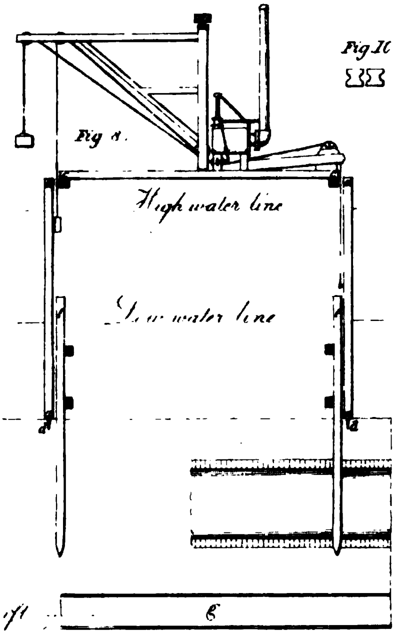


Fig 9

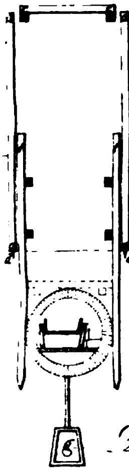


Fig 10.

Fig. 7.

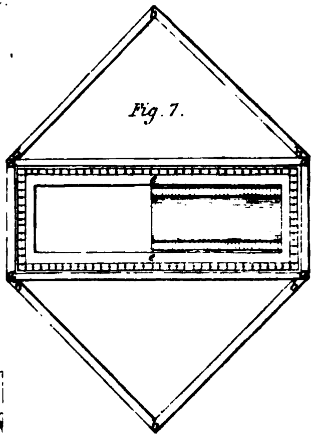


Fig. 1.

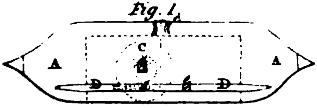


Fig. 3

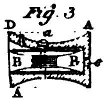
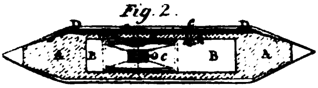


Fig. 2.



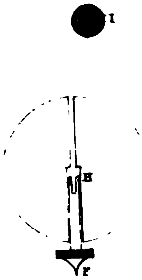


Fig 15.

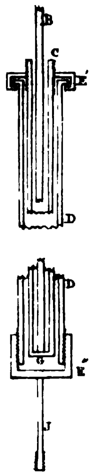


Fig 14.

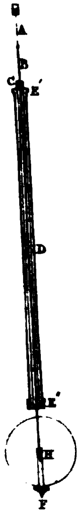


Fig. 4.

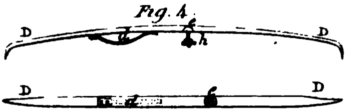


Fig. 5.

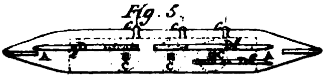


Fig. 6.

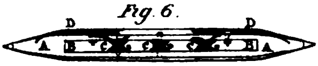


Fig 13

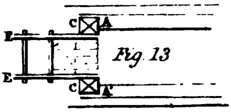


Fig 12

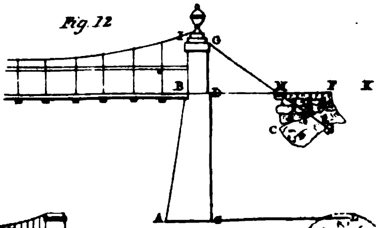
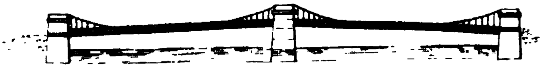


Fig 11



they are obliged to rectify it, and, notwithstanding all their precautions, the work can never be perfect, on account of the stretching not being always alike.

The necessity has long been felt of regulating the stretching of the shoot, in order to produce perfect woven goods. To effect this, the manufacturers have contrived a piece of bent wire, to form a small spring, upon which they pass the little bobbin, *which runs from left to right, the weight of which, when its load is diminished, causes a change in the stretching of the shoot, and consequently the effects of it are visible.* On the other hand, every time the bobbin is changed, it happens that the hole of the new one is larger or smaller than that of the preceding one; then the piece of bent wire does not cause the same resistance, and the workman finds himself obliged to open or to shut this wire, to prevent the bobbin from turning, and emptying itself too quickly or not enough.

These defects have been so fully acknowledged, that many manufacturers have employed all their means to rectify them. They at first substituted another piece of wire, consisting of three branches, in the form of which I have just spoken, and the result was not more fortunate; the reason, as I have just shown, is quite simple. They afterwards followed another method, that of putting in hairs, tied together, so that they might form a kind of little spring to the shuttle, which, forming a kind of brush, deteriorated the goods; for it chafed the thread, and thereby injured its quality and lustre, and so weakened it, that it frequently broke, which obliged the weaver to lose much time in joining the broken threads.

My invention affords a complete remedy for all these defects, and by means of it the work is brought to the greatest degree of regularity.

In order to justify what I have advanced, and to give proof of my experiments, I attempted to make with the fly-shuttle wire gauze, which is more difficult to weave than any thing else, and I have the satisfaction to say I succeeded most completely, and can weave wire gauze with a perfection hitherto unprecedented, and with the same facility with which other goods are woven. The advantages to be derived from my shuttle will appear from the subjoined account of its application in the manufacture of the principal branches of weaving, as follows:

1. *Silk Goods* may be woven of a regular texture, with a most beautiful lustre, and superior both in quality and durability to those manufactured in the usual way, possessing none of those defects which the old method occasions, and which the most skilful hands cannot rectify. There will also be a great advantage from using this invention, in making figured silks in the ordinary method. When it is necessary to use silks of various colours, so many different shuttles must be used as there are colours; but on my principle one shuttle only is necessary, and the work will be most complete; much time will be saved, and more work done, than if the workman were obliged every moment to change his shuttle. I shall also add to these advantages, that of my shuttles containing *ten times* more silk, cotton, &c. than those usually employed.

I must not omit to mention an article of great value, which can also be manufactured with my shuttle in the most beautiful manner, which article I call *Camelion,* from its continual change of colour as it is moved about, and which is superior in brilliancy to any other article hitherto made of silk, possessing great richness and softness, and from its novelty and beauty likely to become very much in demand.

2 and 3. *Cotton and Hemp Weaving*, performed by my new fly-shuttle, appears neater, is more regularly done, quicker weaved, and free from shrinkings, &c.

4. *Flax Goods,* which are manufactured but very rarely with the fly-shuttle, might always be so if those on my principle be adopted, and of any required width, with as regular a texture as the articles abovementioned.

5. *Woollen Cloths.*—All sorts of woollen cloths can be manufactured with the same perfection as the preceding.

6. *Metallic Gauzes.*—These gauzes, which have always

been woven with much trouble, and very slowly, can be made with shuttles on my principle with the same ease as the preceding articles, in the most perfect manner, and twice quicker than what is usual. To give an idea of the great benefits arising from all these advantages, I can venture to assert that the work which is generally done in a week by 300 workmen, can, by my method, be done in that time by 100; which, calculating each workman at 2*l.* per week, will save in wages weekly 400*l.*

There will be also a considerable saving in manual labour, namely, for gauzes of five feet in width, in making which two workmen are obliged to be employed at each loom; by my method the same width can be made by one workman; therefore, with 200 looms, which now require 400 workmen, by my principle only 200 will be required.

The metallic gauzes, of which I have just spoken, are sold now at four shillings the square foot: they can, on my principle, be manufactured at ten-pence!!

A Plan for proceeding with the Tunnel under the river Thames, from Redriffe to Limehouse, taking the present state of things (1809) *as a basis.*

By R. Trevethick, Engineer.

Abstracted from the Papers and Documents of the "Thames Archway Company."

A shaft being already sunk on the Redriffe side, 76 feet below the level of high water, in which are two pumps, worked by steam-engines, capable of lifting 1500 gallons of water per minute; and a drift made from the shaft on the South, to within about 70 feet of low water mark on the North shore, at the depth of 72 feet below high water, the springs of which drift furnish about 400 gallons of water per minute.

It is proposed to excavate a sufficient space in the bed of the river to admit the building of a portion of the tunnel, either of brick or cast iron, the crown of which shall be at a small distance, say 6 or 8 feet, below the bottom of the river.

This excavation to be made, and the tunnel formed, within a set of piles, driven inside a moveable cassoon or coffer dam, of the following construction, and of such a length as the conservators of the river may allow: 40 feet deep, 50 feet long, and 4 or 5 feet wider than the exterior diameter of the tunnel, will be sufficient for the inside dimensions.

In the accompanying drawings, which are calculated for a cast iron tunnel, of 12 feet diameter, 1¼ inch thick, in pieces 6 feet long, inserted one into the other the distance of 6 inches, and caulked.

Fig. 7 represents a plan; fig. 8 a longitudinal, and fig. 9 a transverse section of the cassoon, tunnel, drift, &c.; fig. 10, transverse section of piles.

a, The cassoon, 50 feet long, 18 wide, and 40 deep, made of 12 inch square balk, fastened together with trunnions, and made water tight by being caulked.

b, Screens or fences to break the force of the current, and protect the cassoon from vessels, &c. made of old ship timber, about 36 feet long, attached to the corners of the cassoon, and meeting in a point. These screens or cutwaters are to be the same depth as the cassoon.

c, A platform over the cassoon, on which a crane and a steam-engine, of 4 or 5 horse power, are placed to work a pile-driving and drawing apparatus, and raise the excavated earth to deliver it into barges.

d, Iron spears at the bottom of the cassoon.

g, The drift.

Thus much being prepared, two triangular barges or boxes are to be made to fit the spaces between the cutwaters and sides of the cassoon. These barges or boxes being fixed in their places, are to be loaded with so much ballast as would enable the whole cassoon to be sunk by the admission of water into them. It is then, at high water, to be floated altogether to the deepest part of the river over the drift, with the cutwaters pointing up and down the stream; and when in this situation, a plug is to be taken out of each triangular barge, so that they may be filled with water, and cause the whole to sink, forcing the spears into the bottom of the river, which must have been previously made even by means of ballast barges.

Guiding frames, *e*, 48 feet long, and 16 wide, are then to be suspended or fastened by moveable bolts within the cassoon, and piles, *f*, 40 feet long, and 12 inches square, driven down between the cassoon and guiding frames, till their points are at least two feet lower than the bottom of the intended excavation. The piles must be capped and pointed with iron, and have a semicylindrical groove of 4 inches diameter, extending from one end to the other. Each pile is to be driven with this groove next to the flat side of the adjoining one. After they are all driven, oakum, &c. being well rammed down this groove, will effectually keep out the water. The space also between the tops of the piles and the cassoon, must be caulked at low water, when the tops of the piles will be out of water.

This being done, a hole is to be bored down into the drift, or from the drift up to the inside of the cassoon, and a pipe put in to let the water down into the drift.

Should any thing obstruct the driving of some of the piles, or should they take a wrong direction, they must be left until the rest are driven and caulked, when, the water being drained out, excavations may be made to the bottom of those piles, and the obstruction removed, after which they may be driven to their proper places.

The greatest depth of the river at high water being 38¼ feet, and at low water about 17, the cassoon will be 18 inches above the water at high water, and the tops of the piles 3 feet above at low water; the latter time of course must be taken for the caulking.

Two or three thicknesses of strong well tarred canvass, nailed all round on the outside of the bottom of the cassoon, and spread out on the bed of the river, would take off much of the pressure from the lower ends of the piles, and obstruct the entrance of water under the cassoon.

It is not expected that there will be any necessity for mooring the cassoon, since the weights in the triangular barges may easily be 150 tons more than is sufficient to sink it. This would greatly overbalance the force of the current, which at two miles per hour acts only with five pounds on the square foot, or 5 tons against the whole cassoon. It may not, however, be an improper precaution to protect it from shipping, by mooring an old vessel up and down the stream.

As the water is drained out, beams must be put across inside the cassoon, in order that the pressure on the outside may not force in the sides. When the water is out, an excavation is to be made at one end, the whole width of the cassoon, 18 feet deep, and 6 or 7 long. Beams are also to be put across as the digging proceeds.

When this excavation is completed, a 6 foot length of the cylinder, supposing cast iron to be adopted, is to be put in, the beams being taken from below, and put above the cylinder, as it passes down. Then another 6 feet is to be excavated, and a second length of cylinder inserted 6 inches into the first, and caulked from the inside, when it may be filled with earth, to be taken out again after the whole tunnel is finished. This will prevent its being filled with water, which would have to be drawn out every time the cassoon should be removed. A third length is then to be added to the second, and so on till so much is completed as can be made within the cassoon. The first two or three lengths should be filled with clay, well rammed, to prevent water from the river passing in when the end piles are drawn. The space above the tunnel must be filled with the excavated earth, and puddled to the level of the bottom of the river.

In order to prepare for removing the cassoon forward another length, a set of piles in a frame must be fitted close, and fixed over that end of the tunnel proposed to be continued, and the earth, or rather some clay, well puddled to the frame, so as to prevent any water coming between it and the top of the tunnel to the next length.

The pipe which conveys the water to the drift is then to be stopped, and all the piles drawn except those last fixed. As the piles are drawn, the holes which they leave should be filled up.

When every thing is ready for the removal, and the water low enough to be out of the triangular barges, the plugs must be put in, which will make the whole apparatus float when it is nearly high water, at which time it can easily be moved forward, till the opposite end arrives against the piles that were left. The plugs are then again to be taken out, which will cause it to sink as before.

The same operations as above described must be again performed, and the work repeated, till the tunnel is finished to the shore. After which, the cassoon is to be again fixed in the deep water at the part first began, from whence it is to be continued to the other shore.

A cast iron tunnel of the above size, together with the pavement and superincumbent earth, will about equal the specific gravity of water, but not quite; consequently, if it did not adhere to the earth, it would have a tendency to rise; but taking the adhesion into view, no doubt can be entertained but that it will remain perfectly secure in its bed.

The very small quantity of water that ever can come into this tunnel when finished, might be thrown out by a horizontal forcing pump at the lowest part, worked by a rod, passing along under the pavement to a small steam-engine or horse power on the outside, near the entrance. This would do away the necessity of continuing the use of the drift and large steam-engine.

From borings and other proofs, it is certain that the stratum in which the tunnel would lay at the North side of the river is strong clay, which would occasion no difficulty.

If, as there is every reason to believe, the gravel stratum of 27 feet thick, which was sunk through in the shaft, dwindles to the North into two quicksands, one of 3 feet thick, with 3 feet of strong clay between it; and another quicksand of 4 feet in thickness, under which the declination is one in fifty to the North, there will be gravel or quicksand, or both, towards the South, within the 18 feet which it is proposed to excavate. That this change from gravel to quicksand does take place seems probable, from the circumstance of the quicksands which were met with in the drift being fed with water from the South, and also from their being found where the thick stratum of gravel was expected by calculating the decline from the shaft, as well as by there being no water in any of the strata below the gravel that could feed them; but by borings in the river, and from the different breaks through the roof of the drift up to the bottom of the river, nothing being found but clay from the North shore for about 300 feet southward, it is rendered certain that the gravel stratum does not extend so far North.

It is therefore likely, that as the quicksands rise towards the South, and before they are high enough to interfere with the tunnel, they change to gravel; but should that not be the case, and the quicksand be met with in the excavation, the piles may be driven down through it into the strong clay, which will exclude the sand at the sides.

But should the water in the quicksand be inclined to blow up, the bottom holes may be bored from the drift up to the sand, by which the water will be drained off, and remaining dry, no such effect can then take place.

Admitting, however, that the bottom of the excavation were blown up, no mischief would be done, and very little delay occasioned, because the points of the piles being in firm clay, would prevent their giving way.

Should there be much water in the gravel on the South side of the river, a great deal of it may be drawn off by boring on the side of the shaft.

If a brick tunnel be preferred to an iron one, it will require no variation in the excavation but that of making it something deeper and wider.

Description, measurement and estimate of a Bridge of Iron-wire, constructed over the river Galore, at St. Vallier, in the Department of Isere. By M. Sequin, Sen.

In commencing the translation of this interesting little publication, to save repetitions we think it may be desirable to state, that the *metre,* in multiples and parts of which the measurement of this bridge is given, is equal to 3·281 feet English; that the *kilogram* is nearly two of our pounds; and that the frank, at the medium course of exchange, of 25 franks to the pound, British, is worth 9·6 pence of our money. St. Vallier, where the bridge was constructed, is situated near the Rhone, about 40 miles below the city of Lyons.

I.

This bridge was constructed to determine by actual practice, if some dispositions, which theory indicated, would exactly correspond with the design proposed, and to serve as an experiment and guide for the erection of a bridge on a larger scale at Tournon, about two leagues distant from its scite, and was intended for the passage of horsemen, foot passengers, and beasts of burden. It is situated near a pleasant garden, that belonged to the late M. de Saint Vallier.

The floor (or roadway of the bridge) is raised five metres above the level of the water. Its total length, from the middle of one of the supporting columns to that of the other, is 30 metres, and its breadth is $1{\cdot}65^{m}$.

Strong parapets give it such a rigidity, that fifteen or twenty persons walking over it together occasion scarcely any sensible vibration. To prove it, I have walked over it, accompanied by three of my brothers, stepping altogether, without causing any vibration; and I have since learned, that many persons had passed over it on horseback, although the bridge was traversed at the same time by three other horsemen with their horses, but who, being more cautious, had alighted and led their horses over. I have been also assured that a horseman was seen passing over at full gallop, without the bridge vibrating in any perceptible manner.

This floor is suspended from four iron cables, of about two centimetres in diameter, by means of vertical cords of wire. The wire cables, after having passed over square columns of 2·20^{m} high, are hooked to rods of iron, which are themselves fastened to pieces of oak, loaded with part of the mass of the abutments. It was constructed at the expence of some persons interested in procuring a passage over the river, in the place of an ancient ruined bridge, of whose foundation there were still some parts remaining, sufficiently solid for the support of the abutments.

Its length was at first intended to be 25 metres, and its height 4^{m} above the lowest level of the water. The abutments, A B C D, (fig. 12, Pl. 9) of 1·50^{m} in thickness at the base, A C, and 1^{m} at the crown, B D, accompanied with the side walls, D C L K, of one metre at the base, and 0·50^{m} at the upper part, seemed to me sufficient to resist the draught of the cables, and to serve as a base for the columns of freestone, B D G H, of 2·20^{m} high by 0·65 square, intended to support them. Such were the original designs, which had been already partly executed, when local considerations induced those interested in the work to increase the length of the bridge, at first to 28, and afterwards to 30 metres, and to build the abutments to the height of 5 instead of 4 metres.

The limits of expence to which we were confined, obliged us to use the materials, such as they were, which were intended for the piers, and to continue of the same dimensions the work of the abutments; on which account these different parts were weaker than the calculation demanded. However, as it was of use to determine by a decisive experiment, what confidence we ought to place in the calculations of the resistance of the masonry, and of the masses of the work, we did not hesitate to put it to proof, and it was agreed that we should undertake to furnish, transport, and erect, at our own risk, the whole of the system of suspension and flooring for 1800 francs, which, joined to 1500 francs for the masonry, and from 6 to 700 francs employed on the approaches, and other accessory objects, would form altogether a sum of 4000 francs, to which the whole expence of the bridge would actually amount. Fig. 11, represents the view of the whole, and figs. 12 and 13 the parts. The abutment of the right bank is built on the remains of the old foundation. Its height, A B, fig. 12, is 5 metres above the level of the Rhone, from which it is about 200 metres distant, and its breadth, A A, at the level of the floor, is 3·20^m; its depth at A C is 1·50^m, and at B D 1^m. The side walls, D C L K, on a level foundation, are 1^m thick at the base, and 0·50^m at the top. The columns are all alike; they rest on the angles which the piers make with the sidewalls, and have, as before mentioned, a height of 2·20^m, by 0·25^m square, having on their tops plinths of 0·25^m high, with a projection of 0·02^m.

Above the columns are placed blocks of oak, rounded at the top, 0·40^m broad, by 0·20^m thick, to be surmounted by vases of cast iron, which are designed to be placed there for ornament. These blocks are fastened to the stone by two bolts of iron, 0·30^m broad, by 0·15^m thick, countersunk in the place which the cables were to occupy, in a groove of 0·02^m depth. The four iron cables which sustain the bridge enter into those grooves; they are formed by the union of 30 iron wires, of No. 18, fastened to two half rings, or cushions of cast iron, 0·01^m thick in the middle, and sustained by rods of iron of 0·02^m diameter, which passing through the bars of the half rings of iron, are doubled together and fastened behind pieces of oak, 0·30^m square, built up in the masonry of the side walls, and loaded with two or three large blocks of hard stone, of about 0·50^m cube, over which the walls are raised to the level of the floor, in a manner that admits of repairing or replacing the iron moorings, when thought necessary, in taking up the causeway behind them, without removing any part of the mass of masonry.

This mass, at the right bank of the river, is about 2^{m} high; but that on the left is only raised 1·40^{m}, on account of the elbow of the side walls not permitting it to be extended more than 4^{m} from the piers; nor the weakness of these latter to fasten down the cables in an angle of more than 45 degrees.

The floor is suspended from the cables by 58 vertical cords, each of 4 wires. They are bound on the upper part by some turns of fine wire, softened in the fire, and pass beneath the cross rafters. These cords are formed by a single piece of wire, forming 4 doubles, of which the ends are bound together by wire of No. 1, for the space of about 0·06^{m}. Their length was determined by suspending to a wire, of the same length as the bridge, 29 weights of 0·5^{k} each, and stretching the wire until it formed in the middle a versed sine of 2·20^{m}, equal to the height of the piers. These vertical cords were fastened to the cables in our workshop, and the whole was thus carried altogether and put up in its place, without requiring any great precautions. The cross rafters were then passed through the loops of the vertical cords, and were covered with planks to serve as a scaffold, as soon as they were put in their places; but it was soon perceived that the moorings gave way a little, before all the weight was laid on. This effect, joined to a small lengthening of the iron rods, and to the penetration of the screws into the wood, caused the columns to be drawn forward two or three centimetres. This was immediately remedied by increasing the weight with which they were charged, and by bringing them back, by means of the screws of the moorings, to the vertical position, from which they did not depart any more afterwards.

The cross rafters, 29 in number, are placed 1^{m} asunder; their length is 2^{m}, their depth 0·14^{m}, and their thickness 0·08^{m}: they are attached alternately to each of the cables. The floor is placed directly upon them. It is composed of six rows of planks, 0·26^{m} broad, and 0·054^{m} thick, with intervals between them of 0.01^{m}, to let water pass through.

The parapet was put up as soon as the cross rafters were fixed in their places. It is composed of two rows of rails, of $0{\cdot}11^m$ depth, and $0{\cdot}075^m$ broad, scarfed together, and each kept a metre asunder from the other, by crosses of St. Andrew, of $0{\cdot}06^m$ in thickness. Between each of the joints of this framing are put bolts of $0{\cdot}015^m$ diameter, which, connecting the rails and the cross rafters, give the whole such solidity, that it is impossible, whatever effort several persons can make together in walking or in leaping on it, to give it any vertical movement; but in the horizontal direction its rigidity is less, and a single person, by spreading out his legs so that his feet may approach each of the parapets, may, by balancing himself slowly from side to side, cause a very perceptible movement, and which would soon become disagreeable, and has much resemblance to that which occurs aboard a ship.

This bridge being designed particularly for foot passengers, and for the occasional use only of horses, it was agreed that it should be tried by a weight of 5000^k, which, joined to its own weight, ought to occasion a draught on the cables and the abutments of about $17{,}000^k$. This was no considerable stress for the cables and moorings to bear, but it was almost the extreme limits of the resistance of the left abutment; which, being composed of the parallelopiped, M C E F, of about 5 cubic metres, of 2800^k each, only formed a weight of $14{,}000^k$, which was inferior to that which we required; but the resistance of the moorings might be supposed divided into the horizontal and the vertical, and that it would be sufficient to counterbalance this latter by a weight of $12{,}000^k$.

Such are the circumstances in which this trial was made. The bridge was first loaded with gravel, along with gabions and hand-barrows, until the whole amounted to about 4500^k. Some of those who were interested in the bridge, and who were present, then required that the experiment should be pushed no farther, from apprehension that some parts of the parapet might be injured, and from being certain that the bridge would never be exposed to a weight by many degrees so considerable. But the principal proprietor being absent, and I being besides convinced, as well as my brothers who were present, that there was no danger in completing the trial, we did not hesitate to go on it ourselves, inviting at the same time some persons who were there, to do so likewise, persuaded that some cracks in the walls, or some movements in the masses of masonry, would give us warning sufficiently in time to retire, if there was any danger. The proof then had the following amount:

Gravel	4500
The weight of fifteen persons	900
	5400^k

and men were employed in clearing the bridge, when the proprietor who had been absent arrived. In consequence of an observation which he made, "that the bridge being intended for the service of passengers, he desired to know if it would bear, in a satisfactory manner, 40 persons, walking all at once over the floor," we caused about half the gravel which was heaped on it to be removed, and undertook to go on it with 40 persons, to commence a fresh proof, which we knew was under the amount of that preceding. But the number of curious people who crowded on was such, and their eagerness so great, that it was impossible to stop them in time, and their amount was computed at 70 or 80 persons who were on it together. The whole of the weight then at that time was,—

Gravel	2500
Seventy persons, at 60^k	4200
	6700

This severe proof did not produce the least crack in the walls, nor any movement in the mass of masonry, which seemed to indicate, that with cables and moorings thus disposed, the effect which the calculation announces may be almost entirely depended on.

II.

CALCULATION OF THE STRAINS AND RESISTANCES.

Weight of the materials with which the cables are to be loaded.

IRON AND IRON-WIRE.

Four cables of thirty wires, each 32^{m} long	3840^{m}	
Fifty-eight vertical cords of 4 wires, of a medium length of 1^{m}	282	
Four lower moorings, to keep down the floor, of six wires each, of $8·50^{m}$ long	204	
Fastenings of the cables and cords, estimated	224	
	4500	$261·^{k}$
Weight of a metre of wire	$0·058^{k}$	
Fifty-eight bolts of $1·30^{m}$ long, and $0·015^{m}$ thick, at $1·70^{k}$		98·60
Twenty-four bolts to strengthen the parapets, of $0·02^{k}$		4·80
Nails for the floor		16·60
		$381·^{k}$

OAK TIMBER.

Twenty-nine cross rafters, of about 2^{m} long	58^{m}		$0·65^{m}$	
Squaring, $0·14^{m}$, by $0·08^{m}$	0·0112			
Total length of the rails of the parapet	120		0·99	
Squaring, $0·11^{m}$, by $0·75^{m}$	0·00825			
One hundred and twenty pieces, of $1·40^{m}$ long, forming St. Andrew's crosses	168		0·60	
Squaring	0·0036			
Length of the floor, 30^{m}		4·98	2·68	
Breadth 1·66				
Thickness		0·054		
			4·92	4575·60
Weight of a cubic metre of oak			$930·^{k}$	
Varnish and moisture				43·40
Proof agreed on				5000·
				10000·

This quantity, multiplied by 30^m, the length of the bridge, and divided by $17 \cdot 60^m$, or eight times the versed sine, which we have already stated to be $2 \cdot 20^m$, gives us 17·000.—(*Vide des Ponts en Fil de Fer par Seguin aine. Paris,* 1824.)

But the loading in the proof having been really 6700, it follows that this strain was $11{,}700^k$, which, multiplied by $\frac{300}{176}$ = 20,000 nearly. The four cables are composed of thirty wires each, which, at 500^k to a wire, would altogether sustain $60{,}000^k$. They had been tried in our workshop, each by a weight of 5000^k. The bars of the mooring, of $0 \cdot 02^m$ diameter, eight in number, presented together a section of 2512 square millimetres, at 30^k, = $75{,}360^k$, and had been proved by 2500^k each. There now remain the abutments. That of the right bank had evidently an excess of resistance; but the mass of masonry of the left side having but $3 \cdot 2^m$ in length, $1 \cdot 40^m$ in height, and $1 \cdot 10^m$ in thickness, contained altogether but 5 cubic metres in its solid contents, each at 2800^k = $14{,}000^k$. Supposing then that the strain of the draught, which $17{,}000^k$ produced on the cables, divided in the directions E F, E C, (fig. 12,) and that the mass of masonry was only required to counterbalance one of the component directions, E F, equal to $\sqrt{\frac{(17)^2}{2}}$ or about $12{,}000^k$, and we have just seen that thereal weight was $14{,}000^k$; there remains then in all strictness an excess of 2000^k, with the addition of the cohesion of the side-walls. There was not, besides, any probability that the mass of masonry would slide forward, considering its distance from the abutment. But it was doubtful that matters would happen exactly thus, and whether some parts of the walls, or of the masses of masonry, which, still fresh, could have acquired but little cohesion, would not have separated from the mass. Experience, however, proved that every thing succeeded according to the calculations.

It might be feared, considering the weakness of the columns, that the strain, resulting from the difference of the angles of the cables and of the abutments, might be sufficient to upset them. In effect, the draft of 17,000^k, divided according to the vertical and horizontal directions, caused a horizontal strain from inwards, of

$$\frac{17000^k \times \sqrt{(30)^2 - (8{\cdot}8)^2}}{30} = 16{,}200^k$$

And as the resistance from within outwards only amounted to

$$\frac{17000^k \times \sqrt{\frac{(2)^2}{2}}}{2} = 12{,}000^k$$

The difference, 4200^k, indicated the strain that would take place to overthrow the columns, if cables had been allowed to slip freely over their summits. The resistance of the two at each side, being compounded of their mass, multiplied by half their thickness, and divided by their height, would be equal to

$$\frac{2{\cdot}2 \times (0{\cdot}65)^2 \times 2 \times 0{\cdot}325 \times 2800}{2{\cdot}20} = 760^k,$$

a quantity very inferior to the above. But from the experiments of M. Coulomb, we may calculate that a force, employed in making a body slide over a horizontal plane, is nearly the half of that which would be required to raise it. We may then conclude, without any apprehension, that the friction would be equivalent to 4200 − 760 = 3440, since the resistance ought to be nearly 8700^k, fairly estimated.

As we had principally in view, in adopting this species of construction, to determine the degree of rigidity which the parapet could give to the floor, I have compared, by means of the formulæ given by Navier, the increase of versed sine which ought to be produced by the weight of a horse, which I estimate at 500^k, on a bridge perfectly flexible, with that which it really experienced. This increase will be expressed in denoting by

II.	The weight of a horse	500^k
f.	The versed sine	2·20^m

P. The weight corresponding to the unity of the length of the floor, $\frac{5000}{30}$ .... 160^k

h. Half the length of the bridge .... 15^m

$$f^1 - f = \frac{11f}{4Ph}$$

(*Vide Memoire sur les Ponts suspendus par M. Navier, fol.* 80.) or putting, in place of the letters, the values relative to the particular case which we are examining.

$$f^1 - f = \frac{500 \times 2{\cdot}20}{4 \times 166 \times 15} = 0{\cdot}11^m$$

The degree to which the curve of suspension should be lowered, or the versed sine increased, should be eleven centimetres, while in the bridge itself it is not appreciable.

III.

MEASUREMENT AND ESTIMATE.

Digging for the foundation .... 18^f

Beton (a mixture of cement and small stones or gravel) .... 8^m

MASONRY.

Length of the abutment at the base		$4{\cdot}20^m$			
———— at the top		3·20			
		7·40			
Medium length		3·70	$4{\cdot}625^m$	$23{\cdot}125^m$	
Thickness at the base	$1{\cdot}50^m$				
———— at the top	1·				
	2·50				
Medium thickness	1·25	1·25			
Height			5·		
The same for the other side				23·125	
				54·250	
Length of 4 side walls	58·	43·50		108·750	
Medium thickness	0·75				
Medium height		2·50			
Mass of the moorings				7·	
				$170{\cdot}^m$	1275
Price of a cubic metre of masonry				$7{\cdot}50^f$	
Cut stone for the columns and the angles					200
					1493

IRON-WORK.

Four cables of iron-wire, the particulars of which have been before given, at 2 fr. the kilogram, (the price at which our house delivers them varnished, proved, and ready to put up)		$261^{\cdot k}$	$522^{\cdot f}$
Other forged iron employed in the suspension		120·	
Thirty-eight cramp-irons for the parapets, the blocks, the moorings, and the ends of the floor, &c.		25·80	
Sixteen rods of iron, of 0·02 diameter, for the two abutments	$108^{\cdot m}$	265·20	
Area or section of a rod of 0·02 diameter	0·00314		
Weight of a cubic metre of iron		7800·	
		411·00	493·20
Price of a kilogram of wrought iron	$1{\cdot}20^{f}$		
$4{\cdot}93^{m}$ cube of oak, for the parapet and the floor, at 60^{f}			295·20
Workmanship			150·
Carriage from D'Annonay to St. Vallier			60·
Painting			55·
Setting up			250·
			Fo. 1825·40

Such are the results of this experiment, which completely satisfied us with regard to the analogous dispositions which we adopted at the bridge of Tournon.

This great erection was commenced on the 12th of May, 1824. The river being constantly high during the summer, forced us to lay all our foundations about a metre below the level of the water, by the assistance of a diving bell, of a very simple construction, of our invention, of which I intend to publish a description which I hope will not be without interest in the arts. We had scarcely began to run our (*betons*) cements, when an extraordinary rise in the river carried off our temporary bridges, and a part of our inclosures and of our *beton*. But some weeks favourable to our labours have been sufficient to repair all, and to give us to hope, that in the course of July 1825, the bridge will be ready for the public.

It is composed of two equal traverses, each of 85^{m}. The breadth of the floor is $4{\cdot}50^{m}$, with an enlargement in the middle corresponding to the pier, and on which three carriages can be ranged. It will be sustained by twelve iron cables, each of a hundred wires of No. 18, of three millimetres in diameter, forming a versed sine of eight metres, equal to the height of the abutments above the floor.

Reply of Mr. Herapath *to the Observations of* "W." *on his Compensation Pendulum.* Communicated by the Author.

Bristol, 56, Old Market-street, August 3, 1825.

Gentlemen,

I have read in your second Number an anonymous correspondent's strange remarks upon my description of a compensation pendulum, inserted in Philosophical Mag. No. 325. That description was certainly very short, and the accompanying wood-cut rough; but I did not conceive it possible that I should be so misunderstood. W. makes me say, "the wire connecting the ball with the bottom of the iron tube should be added after the pendulum is made as usual in common clocks." I can assure him such an idea never entered my head; if it had I should have considered the adoption of it quite as strange as he does; for the expansion of the additional wire would not only, as he says, have been uncorrected, but the pendulum would have been too long by many inches to beat seconds. The "usual," in my description, only applied to attaching three inches of steel spring to an iron wire. I did not expect that any reader would require to be told to cut the wire so much shorter as he intended to add in length below, any more than I should think it necessary to tell a man, capable of reading, that B follows A in the common alphabet. This misconception of W.'s is the more unaccountable, as I have given the total length of the pendulum as

$$\left\{\begin{array}{ll} 3\cdot & \text{inches of steel spring} \\ 36\cdot139290 & \text{of iron} \end{array}\right.$$
$$\begin{array}{ll} 27\cdot92 & \text{of iron} \\ \hline 67\cdot059290 & \text{inches.} \end{array}$$

Now as 27·92 of this

must be deducted as duplicature, how could W. find 47 inches left? So much for my material error!

Rough as the wood-cut is, W. will find, upon re-inspection, that the pendulum ball possesses a shoulder in the centre, which rests on the upper end of the screw. Therefore, the ball is supported by the centre, and requires no correction for its expansion, as it takes place equally in every direction.

Having thus shown to whom the "material errors" belong, I shall examine his objection to a tubular pendulum, in order to weigh the difference between the latter and a perfect instrument. The compound rod, when finished, may be but little more than $\frac{1}{4}$ of an inch in diameter; but I will suppose it constructed by a clumsy workman, who could not succeed in making it less than $\frac{1}{2}$ an inch in diameter. A sudden change of 30° in temperature would pass through such a rod in less than $\frac{1}{4}$ of an hour. Now 30° F. operating upon a common pendulum rod for 24 hours, would alter the rate of a clock about 8″ in that time; and consequently, for $\frac{1}{4}$ of an hour, $\frac{1}{96}$ of 8″, or $\frac{1}{12}$ of a second; but as the zinc tube would receive 15° F. while the external iron tube and wire were receiving 30°, the alteration of rate must be less than $\frac{1}{2}$ of $\frac{1}{12}$ of a second.

As I find it is necessary to be extremely explicit, it may be well to inform such as may attempt to make one of those instruments, that as the rod has more weight than a silk string, the *centre of oscillation* will be farther than 39·13929 from the point of suspension, and consequently the zinc tube must in practice be a small portion longer than 27·92. As this small portion cannot well be calculated, my pendulum will, like all others, require an adjustment after being affixed to the clock.

As W.'s remarks may confuse your readers' notions of the instrument, I shall feel obliged by your inserting the following short description of the inclosed drawing.

A. Fig. 14, Pl. IX. The watch spring, 3 in. long.

B. Figs. 14 and 15. Iron wire, fastened to the watch spring, about 32 in. long, having the brass foot, C, hard-soldered to its lower end.

C. The zinc tube, about 28¼ in. long, having a screw cut on its top.

D. The external iron tube, which, with its screw collar, E′, is about 27·6 in. long.

E′. The screw collar, supporting the external iron tube by a shoulder. The elevation of this collar lengthens in effect the zinc tube.

E″. Another screw collar, by holding which steady while the upper one is turned, the length of the zinc tube is altered without altering the total length of the pendulum rod; it is connected with the wire, J, of sufficient length to measure about 40 in. from the knife edge.

F. The screw for regulating the pendulum to time, without affecting the compensation part; it has a point on its head to act as an index for measuring the arc of vibration.

H. The shoulder in the *centre of the pendulum* ball, by which it is supported upon the end of the screw, F.

I. Section across the pendulum rod.

In taking my leave of W. I beg to thank him for his kindness in attempting to correct what he thought my mistakes; and as he seems fond of the amusement, I must direct his attention to the following quotation from his remarks, p. 107:—"The wire, having a *great surface in proportion to its solid contents*, will *more rapidly* come to the temperature of the air on a rise of the thermometer, *than* the tubes!!"

I am, Gentlemen,
Your most obedient Servant,
WILLIAM HERAPATH.

Mr. Herapath's expression in the beginning of his letter, "W. *makes* me say," conveys an accusation entirely undeserved. We have carefully perused both Mr. H.'s original paper, and W.'s remarks, and it appears that in the quotation which W. has made from Mr. H.'s description, commencing at the word "Having," (line 12 from the bottom of page 105) and ending at "pendulum ball," there is no material word added, nor ought diminished.

As to its being "as plain as that B follows A," that three inches were to be cut off the wire, when the spring of that length was directed to be added to it, we differ again in opinion with Mr. H. If readers were to make additions and alterations to that extent, and impute them to writers, the latter would have still less reason to be satisfied, than where they are interpreted as their expressions denote. At all events, Mr. H. after blaming W. for "making him say," as above noticed, should not blame him again for *not making him say* what is not expressed in his paper.

We very willingly insert Mr. Herapath's amended account of his pendulum, but think that instead of our correspondent W.'s remarks confusing our readers, as Mr. H. asserts, they have, in fact, been the means of making the account of the pendulum ultimately understood, which must otherwise have remained problematical.

The wood cut of which Mr. H. complains, is certainly not very good, but it is plain enough to be understood; and without it, most of the apparatus of the pendulum must have remained unintelligible, as it is no where else explained in Mr. H.'s paper. We have examined this cut, and observe a part in the tubular perforation of the bob larger than the rest, which we suppose Mr. H. intended for "the shoulder" which he mentions; but we should also observe, that the nut, on which the bob rests, is very plainly represented at the bottom of the bob, screwed on the wire, and that therefore W. should not be censured for supposing, that it was not intended to place this nut at the shoulder, in the middle of the bob, without which, or some method of conveying the action of the nut to the said *shoulder*, the latter is evidently of no use whatsoever.

We must also beg leave to terminate Mr. H.'s imagined triumph, relative to the wire and the tubes, by the following proof, that wire of a certain proportion to the thickness of the side of the tube, will have a larger surface.

Suppose the side of the tube to be a sixteenth of an inch thick, and that the wire is a sixteenth of an inch in diameter. To compare the two we must divide the surface of the tube into as many portions, equal in size to the wire, each less of course than a sixteenth of an inch in breadth, as can be contained in its periphery. Each of these, then, will have but two sides exposed to the air, while the other two are hidden in the solid substance of the tube; and the wire having the *whole* of its surface exposed, which will be evidently much greater than the exposed parts of the above divisions of the tube, while its solid contents are the same from the hypothesis, will of course more quickly acquire the temperature of the atmosphere.

Observations on the Cutting of Screws. By A WORKMAN.

Communicated by the Author.

HAVING had considerable experience in the construction of new and complicated machinery, and knowing of no method by which minute and accurate movements or divisions may be obtained with such certainty as by means of the screw, it has not unfrequently been the most trying part of my labours to obtain a screw that shall be tolerably accurate throughout, when it has been required of any considerable length. The tapping of screws with new and sharp dies, and great care and slowness, is undoubtedly one of the best, if not absolutely the best method of making a good and true screw. But it is found that when a stock is worked by hand, there is generally a stopping place perceptible on the screw itself, where the workman changes hands, which is most probably the chief imperfection that produces inaccuracy when such screws are set to subdivide their own threads. If one handle be more depressed than the other, the screw will have a periodical variation of obliquity, which workmen call a drunken screw, and it is difficult to avoid this error where the screw is short.

As the dies at best cut rather by the force of the setting screws than the keenness of their own edge, they not only bend the tap or screw, but scarcely ever take equally off from all sides. The best remedy for this is to use long dies; but even with these, a centred and turned tap will seldom prove straight and round after it has received the thread.

In minutely considering the action of the dies it will be seen, that the opposite sides of the thread incline towards different regions, and therefore, in effect, cross each other. Hence it is impossible for the dies to be made to approach each other in the plane of the helix. (A tangental plane to the helix having a vertical axis, will in fact revolve round the axis itself, preserving a constant angular inclination to the same.) But the dies approach in a plane at right angles to the axis. It follows, therefore, that there are limits to diameter, depth of cut, and inclination, beyond which the dies cannot operate. These limits are the cause why a true flat thread screw cannot be cut in dies; and a many-threaded screw, or screw of great obliquity, in a single pair of dies, is impracticable, and can only be cut by a succession of different pairs of dies.

If dies are not well fitted in the stock, and the stuff be veiny or unequally hard, they will yield to the hard parts, and by the effect of this shake produce an undulated thread. Long dies do indeed greatly remedy this imperfection; but it must always exist, however small.

As a pair of well fixed dies can never both run along the same stroke till quite home to their natural place, the cut made by the one will tend to draw the other along the cylinder, so that while one die cuts the upper side of the thread, the other die will cut the opposite or under side. In this cross action the frame and the dies themselves will yield from elasticity, and that the more, where the stuff is most hard or the work forced. Hence, with a like pressure, the soft side will have the widest cut, and be soonest cut down, and the sides of the thread will be waving. This seems to be the chief reason why tapping a screw throws it out of centre and roundness.

It is found by experience, in the attempt to tap a screw much larger than the original of the dies, that the corners of the dies taking hold first, are nearly indifferent as to the run; and if left to operate without pressure in the line of the axis, would as probably cut mere rings, or a left-handed screw, as the right-handed screw (supposed to be in the dies). In these circumstances, therefore, the thread at first turns out to be wavey, with very little rise in the run of each corner, until it suddenly falls into the cut made by the corner it follows. Each turn consists accordingly of four waves, which are amended as the dies sink deeper, and are led by their own slope. But it may be questioned if these waves, once produced, are ever completely removed, so that the screw probably approximates to the truth, without ever attaining it. And in the nature of the operation of tapping, this error in the first instance can only be diminished, but not absolutely removed, because all cutting is begun by the corner of the dies.

Having enumerated what appear to be the several causes of the existing imperfections of screws in general, it may naturally be expected that I should point out some means of obviating at least a portion of the obstacles enumerated. But this I think will not be found so easy a task, and I shall merely describe one method which I have tried with success, and content myself with having partially investigated a subject of the utmost moment to the mechanic, considering that the first steps towards improvement are by the deliberate investigation of the obstacles to be overcome.

In the tapping of a deep flat-thread screw, the breadth of the die, or portion of circle it contains, must be small, because, in a large circular part, the run of the dies is very great from the corner first taking, to the proper or finished position, whence the corners are found to spoil the thread. I have therefore used four dies, in a kind of double stock, having two grooves at right angles, each die being pushed forward and withdrawn by a single screw of the same tap. These screws, which act on the several dies, have each a pinion or small wheel, of the same size and number, which rise above the plate on one side of the stocks, so as all to be moved by one contrate wheel, large enough to present a milled edge or proper hold to the workman. Six or more grooves may be better for large screws. But though this contrivance has partially obviated some of the objections before enumerated, in the manufacture of screws, much remains to be done, and I trust some means may be devised for rendering screws of every description more perfect.

London, Sept. 7, 1825.

Our correspondent will find a paper on cutting screws, by the Rev. Mr. Gilbert Austin, in Repertory of Arts, first series, Vol. II. p. 399, to which we beg to direct his attention, for methods for the purpose, not generally known to workmen. We would also suggest, that improvements might be effected in the cutting part of the tap, or additions be made to it for cutting on some better principle.

Report of the Select Committee of the House of Commons, appointed to inquire into the state of the law and its consequences respecting the Exportation of Tools and Machinery. (Continued from p. 169.)

It is also worthy of observation, that although so early as the year 1497, woollen cloth was one of the greatest articles of exportation, and is so considered in a supplementary treaty of commerce concluded in that year between Henry 7th and the Archduke Philip, Sovereign of the

Netherlands; and although that manufacture continued to be a staple of great importance to this country, arising partly perhaps from the quality of the wool, and partly from the improvements in our machinery, yet no legislative enactment was deemed necessary for its protection, as regarded the implements used, till the year 1750, when the 23d Geo. 2d, c. 13, was passed, in order to prohibit the exportation of the tools or utensils employed in its fabrication. An interval of more than half a century had thus elapsed, during which period no interference on the part of the legislature to prevent the exportation of any kind of tools appears to have taken place. In the same act, however, of 1750, prohibiting the exportation of tools or utensils used in the woollen trade, there is most unaccountably included a prohibition of the tools or utensils employed in the silk trade, although, at that period, the manufacture of silk in this country was still in its infancy, and the implements and tools in use in Great Britain confessedly inferior to those on the Continent.

It will be in the recollection of the House, that one of the principal objections made in the last Session of Parliament to the importation of silk manufactures, was the alleged superiority in implements and tools possessed by the manufacturers on the Continent; a strong proof, in the opinion of your Committee, of the folly of prohibiting by the act of 1750 what there could not be the smallest inducement to export, and of the total absence of any sound principles or correct data in the commercial legislation of that period.

The 14th Geo. 3d, c. 71, (1774,) the next act on the statute book, exhibits a similar inconsistency in prohibiting the tools and utensils used in the *cotton* and *linen* manufactures, or a mixture of either. It is well known that in France, Germany, and other parts of Europe, the linen trade had then arrived at a very high degree of perfection, and that, whatever precautions might have been deemed necessary in regard to our improvements in cotton machinery, no tool or utensil possessed by Great Britain at that period, for the manufacture of linen, could have been an object of importation on the Continent.

Your Committee cannot pass over the act of the following year, 15th Geo. 3d, c. 5, (1775,) without observing, that it permits the exportation of wool cards, or stock cards, and spinners' cards, to the British Colonies in North America; because, says the act, "the prohibition to ex-"port them had proved extremely prejudicial to great "numbers of poor families in England." And your Committee may be permitted to remark, that every prohibition of the same kind, if not followed by the same consequences, has at least been productive of no apparent benefit to any part of the community.

Although actual injury to the industry of the country had thus become evident, in one branch, from restraining exportation, the legislature, in compliance with the application of several manufacturers, proceeded, by the 21st Geo. 3d, c. 37, (1781,) in the spirit of former enactments, to forbid, not only the exportation of all tools, but also of all models and plans connected with the *wool, cotton, linen,* or *silk* manufactures, under a penalty of 200*l.* for each offence, and the forfeiture of all articles so prohibited, if attempted to be exported.

A further prohibition took place in 1782, by the 22d Geo. 3d, c. 60, of all *blocks, plates, engines,* tools, &c. used in the *calico, cotton, muslin,* or *linen printing* manufactures; and in 1785, by 25th Geo. 3d, c. 67, the *iron* and *steel* manufactures appear, for the first time, to have occupied the attention of the legislature, and a long list of tools and utensils, including, in fact, almost every tool or utensil that could be used "in repairing, working, finishing, or "completing the iron and steel manufactures of this king-"dom, by whatever name or names soever the same shall "be called or known, now or at any time hereafter, and "also of any models or plans of any such tool, utensil, or "implement," under severe penalties, as if to prevent the industry of the country from being employed in the manufacture of any of those numerous articles required for any other part of the world than the United Kingdom.

That act would appear, however, to have had a particular reference to the *button* and *buckle* trade, which the legislature seems to have been anxious to monopolize for this country, as almost every tool employed in their manufacture (as will be seen in the Appendix), is especially designated; but the buckle trade may be said to have entirely ceased along with the fashion which gave it birth, notwithstanding these bolstering precautions. With respect to the button trade, great improvements have been made in those kinds used for home consumption; and though our manufacture of them is equal, if not superior to any in Europe, yet it appears, by the evidence of Mr. Osler, from Birmingham, that the fancy button trade is almost entirely lost to this country, notwithstanding the precautions of this act to retain it. From his statement, on the authority of Mr. Ledsam, one of the largest button manufacturers in Europe, it would appear that England at one period supplied France, Germany, Italy, and Switzerland with buttons; and that in Birmingham alone 20,000 gross were made every week for the foreign market. The reasons assigned by Mr. Osler for the loss of that trade, partly explain the cause; namely, that copper could be obtained on the Continent at 60 per cent. less than in England, owing to the protecting duties imposed in favour of the mining interests in Cornwall; and that the stamp duty on silver, and other charges, raised the price of the article so as to render competition with the French and other manufacturers utterly impossible: an additional proof, if any were required, that the low price of any article of equal quality, is a better security for an extended market than any legislative restriction on exportation of the tools employed in its manufacture.

Your Committee have deemed it proper to notice this act (25th Geo. 3, c. 67) the more particularly, as being the most comprehensive and sweeping in its enactments against the exportation of tools, in order that the House may judge of the inconsiderate manner in which it must have been passed, as by the acts of the following year (26th Geo. 3, c. 76 and 89) it is repealed, and another long list of exemptions (inserted in the Appendix) enumerated, which render the law at present so complicated, that, exclusive of the difficulty of discriminating the particular kinds of machinery, as stated in the evidence, it is extremely difficult, if not impossible, to ascertain what are and what are not prohibited.

It is deserving of notice, that by the 26th Geo. 3d, c. 76 (1786), it is declared that, "as the exportation of "wool cards to North America had been beneficial to this "country, and as the allowing of a general exportation "thereof to foreign parts will be highly serviceable to a "great number of poor families in England, employed in "the trade of making such wool cards," the same were then and are now allowed to be exported to all parts of the world.

Neither the grounds on which these acts were passed, and repealed, nor the advantages expected to be derived from them, appear to have been well understood; as by the 25th, (c. 67,) the prohibition was perpetual, whilst by the 26th, (c. 89,) it was provided that the prohibition should only continue in force till the end of the next session of Parliament, and *no longer*.

Your Committee beg leave to state their opinion, that changes in laws which regulate the export and import of any article, should be made as seldom as possible, as by every change new establishments and connections in commerce must necessarily be formed; and, exclusive of the loss of capital consequent thereon, the uncertainty to which they give rise in the minds of merchants and manufacturers must greatly tend to impede the commerce and check the prosperity of the country. Many able and intelligent men have even gone so far as to assert, that it is often much better to submit to inconvenience and loss than to make a sudden change in any extensive branch of the industry of the country, although that change might ultimately remove the inconvenience and loss suffered; yet so great has the uncertainty been as to what line of conduct the legislature would ultimately pursue, that the statute book affords, in the instance of machinery, a notable example of the total want of any fixed principle; exhibiting, in the same year, one act to permit the exportation of one kind of tools, because their prohibition had proved injurious to the industrious classes of the community; and another, prohibiting the exportation of other kinds, because such exportation was considered to be detrimental; and the provisions of that act, which would have expired in 1787, were continued from year to year by the 27th, 28th, 29th, 30th, 31st, 32d, 33d, 34th, till, by the 35th Geo. 3d, c. 38, it was rendered perpetual.

These acts also prohibit the exportation of all tools, implements, and machines, used in coining money, although it would be extremely difficult to show why any country should have impediments thrown in its way for coining money for its own use, or what possible injury this country could sustain from supplying other nations with the various and expensive machinery which is necessary in large quantities to the establishment of mints. No permission, however, appears to have been granted by legislative authority for this purpose, except in one solitary instance, namely, in that of Mr. Matthew Bolton, an engineer of Birmingham, who, by the 39th Geo. 3d, c. 96, (1799,) was permitted to export the machinery necessary for the erection of a mint in the dominions of the Emperor of Russia, and to send workmen there to erect the same. But His Majesty's Government, as appears by the evidence, have, under the exigencies of the case, thought it right from time to time, on special applications, to grant licences for the exportation of different articles of machinery to various parts of the world.

The Committee, in 1824, examined many practical men for the purpose of ascertaining how far, in their opinion, the prosperity of our manufactures had been promoted by the laws which prohibit the exportation of tools and machinery, and how far the improvement of the manufactures of other countries had been thereby retarded. Many of these witnesses were of opinion, that considerable advantage had accrued to this country from the protection which these prohibitory laws gave to our manufactures, by their operation in preventing foreign nations from becoming our rivals in several branches of manufactures: but a careful perusal of their evidence will best show the grounds on which those opinions are founded.

In addition to the examination of persons practically conversant with machinery and manufactures, that Committee called before them, and examined, two gentlemen eminently qualified to determine, on general principles, the policy of prohibiting the exportation of tools and machines. These gentlemen gave their reasons at length for believing the prohibition to export tools and machines to be injurious to the commerce and manufactures of this country, inasmuch as we thereby shut ourselves out from a new branch of business which would give employment to a large number of our people, increase our own capabilities, add considerably to the amount of our productions, and consequently to the increase of capital; particularly so, as the materials of which tools and machinery are made are almost entirely the products of our own soil, and may be procured by the labour of our own people in unlimited quantities.

Your Committee beg leave, however, to call the attention of the House more particularly to their evidence, which contains matter of the greatest importance, as it explains many of the grounds on which, in the opinion of those gentlemen, commercial intercourse, in order to be prosperous, should be founded.

Another circumstance of some moment, to which your Committee beg leave to request the attention of the House, is the commercial jealousy which the prohibition to export tools and machines is calculated to perpetuate, and the effect which the repeal of these laws would produce on the policy of other nations towards us, and how far the removal of all such causes of jealousy would operate in respect to many regulations and restrictions now existing on commerce, which the members of every enlightened government must necessarily wish to see removed, and which the legislature appears to have had in view in the late various important alterations in the commercial relations of this country.

The evidence taken by the Committee in the last Session was such as to induce them at that time to decline recommending any measure to the House beyond that of a renewal of the inquiry in the present Session; and in order to make this inquiry as complete as possible, the Chairman of your Committee caused a notice (inserted in the Appendix) to be sent to the principal municipal officer and chambers of commerce in many of the great manufacturing towns of the United Kingdom, some of whom, it appears, caused it to be inserted in several of the provincial newspapers.

It is necessary to observe, that notwithstanding this public notice, no person from any of the manufacturing districts has requested to be examined before your Committee; and that only two answers to his circular were received by the Chairman; one from the Chamber of Commerce in Birmingham, inclosing a copy of the resolution of that Chamber, of the 12th of March, 1824, which objected both to the emigration of artizans and to the exportation of machinery; and as the evidence of the witnesses deputed by that Chamber at that time will be found in the minutes of the Committee of last year, it is presumed that they had no additional evidence to offer; the other from the master cotton spinners of the county of Renfrew, appointing Mr. Dunlop (whose evidence on the subject will be found in the minutes of last year), to oppose any bill for permitting the exportation of machinery. As no person, therefore, came forward from the country to offer evidence to your Committee, it was necessary more particularly to revert to the evidence taken by the Committee in the last Session, for the purpose of more fully showing its tendency.

Almost all the principal engineers whose factories are situated in the metropolis, were examined. Their evidence tends to show the injurious consequences of the laws which prohibit the exportation of tools and machines, and all of them concurred in recommending their repeal. Several machine-makers, resident in the country, were also examined before the Committee, all of whom agreed in recommending a revision of the laws, or that particular kinds of machinery might still be legally exported, while other kinds might be prohibited. They also concurred in opinion that much of the machinery at present prohibited might be advantageously exported; but gave it as their opinion that other kinds of machinery, and particularly those used in the manufacture of cotton goods, should not be permitted to be exported. This opinion was grounded on an apprehension that foreigners might in time be able to manufacture such goods, not only for their own use, but also for exportation, cheaper than we could, and might thus supersede us in the foreign market. They were also apprehensive that the orders which might be received from abroad for tools and machines, would raise their price at home, and prevent our own manufacturers from being supplied with the machinery they wanted; and several manufacturers concurred in these opinions.

The objections made by the machine makers and manufacturers were thus reduced to two: viz.

1st, That in consequence of the large foreign orders which would probably be sent from abroad, the price of the tools and machines, if the free exportation were permitted, would be considerably and permanently raised at home.

2d, That it was to be feared that, in a short time after the repeal of those laws, foreigners would be able to undersell us in cotton goods, in lace made in frames, and in some other branches of manufacture.

To these two principal objections your Committee more particularly turned their attention; and in the evidence of all the London engineers it is distinctly stated, that they do not believe that any considerable rise of price would, for any length of time, follow the repeal of the prohibiting laws. On this subject, however, your Committee submit to the consideration of the House an extract from the evidence of Mr. Alexander Galloway.

" Do you then think that we should secure a very con-" siderable and profitable branch of permanent manufac-" ture, without injuring our home manufactures, if this " law was repealed?—I am decidedly of opinion we should " improve our condition; and if I was a considerable ma-" chine user in any of our principal manufactures, I should " say I should be very much benefited by taking off the " prohibiting laws, as it would ultimately lessen the price " of machinery.

" Do you mean by the increased competition and skill " that would be brought into action?—Yes; and that will " all end in making machines cheaper. At first it may " increase the price with certain individuals, but not with " the manufacturers generally; and ultimately it will in-" crease the means by which machinery is produced."

The principal difficulty which seemed to your Committee likely to occur, from any considerable increased demand for machines from abroad, was the number of hands which could in a comparatively short space of time be procured to meet the demand.

It has always hitherto happened, and on general principles it may safely be affirmed that it will always happen, that where a commodity can be supplied in unlimited quantities (which machinery may be in this country) a large increase in the demand never fails, after a very short period, to reduce the price; but the necessity of instructing men in machine-making seemed to oppose an obstacle which it would require much time to overcome; and it was apprehended that in the mean time the price of machines might be considerably increased. The opinion, however, of the London engineers was, that no difficulty whatever would exist as to the procuring of hands capable of constructing machinery in any quantity which could be required; and that, too, greatly to the advantage of a large number of persons.

Messrs. Martineau, Bramah, Maudslay, and Galloway, all of them eminent in their profession as engineers, affirm that men and boys in almost any number may be readily instructed in the making of machines, and that the great improvement of the tools used for making machines, and for the abridgment of labour in many important parts of the business, (which enables them to employ common labourers, who may rapidly become skilful workmen) furnish reasons for believing that the price of machinery is much more likely to be reduced, and that in a short time, than increased by any considerable extension of the business of machine-making. Your Committee would, however, call the attention of the House to the evidence of Messrs. Ewart, Kennedy, and other witnesses from the country, who have expressed a contrary opinion, in order that a correct judgment may be formed on the subject.

To be continued in our next Number.

On the Extraction of Opium from the indigenous Poppy.

By M. Laine.

From Bibliothéque Universelle.

In October, 1821, the author had a considerable space sown with poppies of the kind called *blind* poppies, disposed in rows two feet asunder. Although these poppies made a very indifferent appearance in the spring, they greatly improved afterward, and every one produced from 8 to 20 capsules. In April the ground was dug and raked, and in May the plants were earthed up. Most of them grew to the height of four feet and a half.

The method followed by the author to gather the produce, consisted in making incisions in every head or capsule, with an instrument formed of two blades or edges, fitted into a little wooden handle, so as not to project beyond it more than about a quarter of a line, the incisions being as much as possible in a spiral direction. Children followed the person who cut the poppy-heads, and gathered the milky juice which escaped with a small brush or pencil, the size of the little finger. When the pencil was full of juice, they pressed it with a finger against the inside of a little tin vessel, in the same way that painters press the oil out of their brushes in order to clean them. At the end of every half day's work, all that was collected was put together into a flat vessel, where it was left to evaporate to dryness.*

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* The *milky juices* of vegetables owe, in general, their milky appearance to a certain quantity of resin or of fatty substance which they hold in suspension. They likewise frequently contain different substances soluble in water, particularly mucilage.—See Annales de Chimie, Vol. XLV. p. 257; v. 21, 275, and 288.

NOTICES OF NEW PATENTS.

Patent granted to WILLIAM CHURCH, *of Birmingham, Esq. for certain improvements in casting cylinders, tubes, aud other articles of iron, copper, and other metals.* Dated January 18, 1825.

THE plan for which this patent was obtained, consists of exhausting the air by air-pumps from the moulds, prepared for receiving the melted metal so as to be air-tight; and forcing the melted metal from air-tight vessels into those exhausted moulds, by the action of compressed air, impelled by air-pumps over the fluid metal. The patentee states that there are many methods of doing this, depending on the nature of the castings and moulds, which cannot be all described; but gives the following example of the mode of applying his plan in casting iron rollers.

The mould is to be inclosed in an air-tight case of cast iron, from the bottom of which a tube of earthen ware (such as is used in making crucibles) is to descend, and from its top a pipe is to pass to an air-pump (which is represented in the drawings of a large size in proportion to the mould), and beneath which is an air-tight vessel, which may be exhausted by it, and whose use is to accelerate the process of exhausting the mould, by previously pumping the air out of it, and opening the communication between it and the mould, which is made by continuing the pipe from the air-pump to it, and having cocks so placed in its passages, that the air may pass from the mould either to the pump or to the vessel, by opening some cocks and shutting others, as the occasion demands. The pan containing the melted metal is placed beneath this mould in an iron chest, with charcoal dust between the two, to retain the heat, and the earthenware tube of the mould passes down into the melted metal, through a circular lid with conical edges, that closes the chest so as to be air-tight, an expanding ring of metal being placed between the two, to make the junction more perfect; but how it effects this purpose is not sufficiently explained, or the manner in which the lid is pressed down on the top of the chest, though this latter may be more easily conceived; the air-pump before-mentioned being constructed so as to act as a forcing pump as well as an exhauster, and a pipe passing from it to the chest that holds the pan of fluid metal, and a cap of metal that will readily melt being put on the end of the earthen tube, and that being passed through the lid of the chest, and its juncture with it, as well as that of the latter, with the chest, being all made air-tight; the earthen tube descending through the melted metal within an inch of the bottom, and the mould being previously exhausted; as soon as the cap is melted of the earthen tube by the red hot fluid metal, this latter will begin to ascend through it into the mould, and at the same time the air-pump, being worked so as to force the air into the chest that contains the pan of melted metal, its pressure will accelerate the rising of the fluid metal into the mould.

A pipe is represented passing off sideways into the vessel beneath the air-pump already mentioned, from the pipe that goes from the pump to the chest, and a cock with three ways is placed at the joining, so that the passage to the pump, or to the vessel, may be opened from the chest as desired.

Round the metal case of the mould another external case is exhibited in the figure, with a cock near its bottom, the use of which is to admit cold water round the mould, to cool the casting more rapidly, when it is expedient to case-harden its surface.

The mould is furnished with gudgeons for attaching chains, by which to lift it into its place over the fluid metal by one of the cranes commonly used in founderies; and the pipes have union joints, in the proper places, for connecting them together, to form the communication with the air-pump described, when the mould is lifted into its place by the crane.

There may be cases of peculiar castings, having very minute parts, or complicated ramifications, or whose surfaces require uncommon accuracy, where this apparatus would be of great use; but for general purposes it is obviously too expensive; nor do we believe it was intended for such, the common methods having been brought to very great perfection for them. We believe the statement of the patentee to be perfectly correct, that castings made in his method will be less liable to flaws, hollows, or minute cavities, called honey-combs, and other defects; and therefore it is probable that, as well as to the uses which he mentions by name in the title, this plan might also be applied beneficially to the casting of cannon, and to the highest branch of the founder's art—the making metallic statues.

It is probable that the vessel beneath the air-pump is intended by the patentee to hold compressed air occasionally, though not expressly mentioned by him, on account of the pipes from the chest, that holds the pan of melted metal, having a commūnication with it near its upper extremity.

Patent granted to SAMUEL CROSLEY, *of Cottage Lane, City Road, Middlesex, Gent. for an improvement in the construction of gas regulators or governors.* Dated February 1, 1825.

MR. CROSLEY commences his specification with an account of two other methods before used in the construction of gas regulators. The first is formed like a small gas holder, moving in water as usual at its lower extremities, but having a rod suspended from the centre of its top, ending in a cone, whose broadest part is placed downward, and lies below a round aperture in the bottom of the gas holder, through which the gas enters from a lower compartment of the apparatus, and which this conical stopper reduces in extent as it is raised up by the elevation of the upper part of the gas holder.

The other method consists of an implement formed like a bellows, having a round aperture in its lower plank; which is reduced in size by a conical stopper, suspended by a rod from its upper plank, in a similar manner to that described, and which closes its capacity in proportion as the bellows part is inflated by the entrance of the gas, and the top plank is thereby elevated.

Mr. Crosley's improved gas regulator consists in a cup or vessel, which he improperly calls "a tank," whose mouth is covered with gold beaters' skin, oiled silk, or any similar flexible substance, so as to exclude the passage of air. This flexible cover is, however, not to be stretched tight, but is to have that degree of relaxation which will allow of its centre being moved up and down sufficiently to have the same action on a conical stopper, similarly constructed, and suspended in the same manner as those described, which reduces or enlarges the extent of an aperture in the bottom of the vessel, through which the stem of the stopper passes, in proportion as the flexible cover is raised or depressed by the action of the gas, that flows through it from a lower compartment of the gas regulator, into which a pipe passes from the large gas reservoir; while another pipe, that goes out from the side of the vessel, conveys it to its destination.

Small disks of pasteboard, or of other proper material, interposed between the centre of the cover and a flanch, near the top of the stem of the stopper, and through which it passes, serve to make that part gas-tight, when pressed together by a screw and nut on the top of the stem. The edges of the cover are also made gas-tight by a flat ring that lies above them, over the mouth of the vessel, to which it is pressed down by screws that pass through both. Above the flexible cover is fitted a case to secure it from injury, so constructed as to allow sufficient space for its motion upwards.

Weights may be fastened on the upper part of the stem of the stopper, above the flexible cover, to regulate the degree of pressure of the gas by which the aperture beneath is to be closed.

This regulator will form an instrument of sufficient delicacy and lightness of operation to be used with single burners, for which purpose we suppose it was intended, though the patentee does not declare his design in this respect.

We think the stopper would move more steadily up and down, without being liable to lateral motion, by having its stem passed through a hole or ring, in the middle of a wire, fixed across the aperture in the bottom, and sufficiently below the flexible cover not to interrupt its movements.

We object to the cup or vessel of this regulator being called a "tank," because this word, which we have imported from the East Indies, really means a large artificial pond of water, and therefore is not a proper appellation for a small vessel, either directly or figuratively.

Patent granted to WILLIAM RHODES, *of Hoxton, Middlesex, Brick-maker, for an improvement in the construction of clamps for burning raw bricks.* Dated November 20, 1824.

MR. RHODES, in the beginning of his specification, gives an account of the common method of making clamps of bricks; in which, after describing the way in which the clamps are raised with courses of *raw* (unburnt) bricks, stratified with cinders, or *breeze* (small cinders), inclosed by walls of inferior burnt bricks outside, he states that the whole is covered at top by three or four courses of soft burnt bricks, placed flat and close together, and arranged so that those in one course shall cover the interstices of the course directly beneath, which is commonly called *breaking the joints.* These bricks so placed are called *cantlings* by the brick-makers. Above these courses, three or four more courses of the same sort of bricks are placed *edgewise*, but arranged in every other respect as the former, and these latter are called *plattings*.

The use of these upper courses is to protect the raw bricks from rain, which it is highly necessary to keep off; for if the raw bricks get wet, it is found that they can never be burned hard, and will only produce the sort called *shuffy* bricks.

This covering the patentee states effectually kept off the rain, and yet there were always some courses of shuffy bricks, found at top of the clamp when burned, beneath the covering, by which a considerable loss was incurred. This the patentee attributed to the steam from the raw bricks, at the bottom of the clamp, ascending when the fires were kindled, and condensing on the raw bricks in the upper courses, on account of their being colder than those beneath, which induced him to try methods to prevent this evil, of which the following one succeeded to his satisfaction, and is the object of his patent.

The clamp being built as usual to near the top, the patentee sets the two or three last courses of raw bricks about half an inch asunder, and fills these interstices with breeze; over these he places one course only of *cantlings*, arranged with the species of intervals between them, called *pigeon holes*, continued from one end of the clamp to the other. Above these, he places three courses of *plattings*, the lowest course of which are at every 14 or 15 feet to be *pigeon holed* across the clamp; and he covers the whole, particularly at the end of the brick-making season, with 3 or 4 inches of brick dust or soil. By this method, in the first place the steam gets vent completely through the *pigeon holed* passages, lengthwise in the course of *cantlings*, and crosswise in those of the *plattings;* and secondly, the heat produced by the burning breeze in the upper courses of the raw bricks, both prevents the steam from condensing on them, and burns them more completely; and lastly, the covering of soil or brick dust secures the whole better from rain, and more effectually reverberates the heat.

The method of constructing brick clamps, proposed by the patentee, seems very judicious, and founded on just principles; but such are the variety of methods in which bricks are arranged in the clamps in different parts of this country, and so various are the ways in which they are covered, that the chance must be very great of some of them being sufficiently similar to the method of the patentee to render it very doubtful whether he could sustain his patent, and to make it more prudent for him therefore to look for profit from his method of brick-making, to the advantages it must produce in his own practice, or in directing the construction of clamps for other brick-makers, for which he has proved himself eminently qualified, by his observations on brick burning in his specification, as well as by his proposed improvements.

Patent granted to William Shelton Burnet, *of London-street, Merchant, for a method of lessening the drift of ships at sea, and better protecting them from gales of wind.* Dated January 11, 1825.

The method of lessening drift of ships, recited in the specification of this patent, is by letting down to the windward a square plane, attached to a floating plank, with chains eleven feet long from the angles at one side to those at the opposite sides, connected in the middle by a loose ring, to which a hawser is to be fastened from the ship; a cord also passes to the ship from each end of the plank to direct the position in which this is to lie with respect to it. The square plane being directed by the cords to lie at right angles to the drift of the ship, and not being moved by the wind from lying very low in the water, will of course, in being drawn forward by the hawser, make a resistance to the motion of the ship to the leeward, proportional to its hold in the water, which will be equal to its surface multiplied by the square of the velocity of its movement.

The square plane consists of a frame of bar iron, bolted to the plank, with strong canvass, turned over and sewed to the upper bar of the frame, and laced by cords passing through holes in it, to the bottom bar and to those at the sides. The plank is a little more than three times the length of the frame, and is formed of three pieces, united by hinges at each side of the frame, with bolts over the hinges, so arranged that when the two outside pieces are opened up so as to be in a line with the middle piece, the bolts, being protruded, will keep them in that position; and when they are drawn back, will admit those pieces to be brought down by the sides of the frame, in order that the whole may take up less room in stowage, when not required for use. The chains connected by the ring in the middle, and drawn by the hawser, will pull the whole forward equally, without permitting one part of the frame to be acted on more than another by the resistance of the water. The dimensions of the frame are not mentioned, but from the length of the chains being eleven feet, it is supposed it could not be more than about seven feet long at each side.

This plan was first proposed by Dr. Franklin, who took the idea of it from a school-boy's kite, and had an apparatus for the purpose fitted up in the same manner, and very like one, an account of which may be seen in the Transactions of the American Philosophical Society. The dimensions proposed by the Doctor for the plane, as well as those inferred from the description of the patentee for his, seem much too small to be of any effectual use for the purpose intended.

Patent granted to Mr. FRANCIS GYBBON SPILSBURY, *of Walshall, Staffordshire, for improvements in tanning.* Dated April 22, 1823.

FOR Mr. Spilsbury's method of tanning, oblong square frames are provided, with metal loops fastened round their edges. On one of these a skin or hide is stretched, after being limed, cleansed, and prepared in the usual manner for tanning. Over this hide another of the frames is placed, then a second hide is laid above it, and a third frame is put above that. The three frames are arranged so that the metal loops of each shall be opposite those of the others; screw bolts are then put through those loops, and screwed up sufficiently tight to prevent any liquor from passing between the frames and the hides. The whole is then set up edgeways, and there being two short pipes, furnished with cocks, in the upper edge of the middle frame, a pipe, in which there is also a cock, that descends from a cistern holding tan liquor, is fastened to one of these by a union joint; and another cock being placed near the bottom, in the same frame, to let off the liquor when required, completes the whole apparatus.

The cock at the top, that communicates with the tan cistern, being opened, and the other near to it being also opened, while that at the bottom is shut, the tan liquor will run down between the hides, driving out the air at the other open cock; which, as soon as any liquor appears in it, being shut, the tan liquor will then distend the hides and press outwards, with a force proportional to the height which the tan cistern is elevated above the frames. The consequence of which pressure will be, that the tan liquor will ouse through the pores of the hides, appearing at the outside like dew; and by thus bringing fresh portions to act continually on them, will, in the opinion of the patentee, cause them to be tanned much more speedily than happens in the common method, in which the hides lie in the liquor, after it has ceased to operate on them, and are only passed into fresh liquor at intervals by a tedious manual operation.

The frames are to be made of wood or copper, and if iron should be used for them it must be well painted, to prevent its making the hides black.

In some cases two skins or hides may be put at each side of the middle frame; and when the whole are well tanned, the tan cock is to be closed, the liquor is to be run off at the lower cock, and the frames separated from the tan pipe and from each other; and the hides being removed, and having their edges pared off, which were nipped or compressed between the frames, are then to be dried and finished in the usual manner.

Nothing further is stated in the specification respecting the time which this process will require, but that it must depend entirely on the nature of the hides or skins.

This method of tanning has attracted much attention; and it is reported that hides of that thickness to require a year for tanning in the common method, can be finished in this in six weeks; and that some skins can be tanned by it in eight or nine days; it is also said, that a very large sum of money has been offered for the patent right.

The theory of the process appears to promise well for quick performance, but on these occasions it is necessary to attend to facts; and we have been informed by some gentlemen in the trade, that the hides are not tanned evenly by this method, but leave spots less acted on by the liquor than the rest; and that leather made in this way is not so durable as the common sort.

The quantity of the hides that must be pared off when they come out of the frames, must certainly diminish the value of the process, and especially when oblong-square frames (such as are represented in the figures of the specification) are used, which, not being of the natural shape of the hides, must cause more waste; which must be worth consideration, even though the parts to be cut away are the least valuable of the hides.

It must, however, be considered, that this method of tanning is still in its infancy, and that it will be probably improved in time, so as to diminish some, and totally remove others of these objections made to it.

Patent granted to Mr. Josiah Parkes, *of Manchester, Engineer, for a method of manufacturing salt.* Dated December 4, 1823.

This method of manufacturing salt consists in using a boiler for the purpose, of a very singular shape, contrived to let the salt fall below the level of the fire-place, from whence it is drawn off through a cock, along with a portion of the brine, instead of being taken out by rakes and shovels in the usual manner.

The boiler is to be made of a conical form, having its height equal to its extreme breadth, and obtruncated so as to leave an opening of the extent of one fifth of the diameter of its base towards its apex. This conical part being placed with its base upwards, a cylindrical vessel, of the breadth of this opening, and twice its depth, is attached to this part, the bottom of which vessel is likewise of a conical form, and terminates in a cock.

The top of this boiler, which in this position is its broadest part, is covered with a dome; above which rises a short cylinder, large enough to admit a man, which has a cover screwed down on it, in which is placed a safety valve; and from its opposite sides issue two tubes, to convey the steam to the open air. This boiler, with the cylinder appended, having its parts connected with rivets and screws in the usual manner, and being made of the usual materials, is set in brick work, and partly supported by a projection at its largest periphery, and partly by a broad circular plate, placed below its cylindrical termination, and perforated so as to permit the conical bottom of this part to pass through. This plate is represented in the figure three times the breadth of the cylindrical part of the boiler, and resting on an arch into which its conical bottom and its cock passes. A ring is attached to the top of this cylindrical part, and another ring being placed outside of about thrice its diameter, concentrical with the first, joggle bars are laid between them in the lines of the radii, to support the fuel; and the fire-place is constructed round this larger ring, having an opening at one side furnished with an iron door to admit the fuel, and an ash-pit all round of the depth of the cylindrical vessel which it encloses, and of the breadth of the grate. Above the fire-place, spaces are left all round between the boiler and the brick-work, for the passage of the fire and smoke upwards, from which a flue conveys the latter to a chimney.

Above the boiler at one side is placed the cistern, which holds the brine, and from it a pipe descends to the level of the bottom of the cylindrical termination of the boiler, into which, at this part, a branch from the first pipe proceeds, and another branch passing from the same pipe to the top of the boiler near the dome, all three being furnished with stop-cocks, completes the apparatus.

The whole being constructed as described, the boiler filled with brine from the cistern by the pipes, and the latter brought to boil by a due application of fuel in the fire-place, the salt, which will soon begin to form as the water evaporates, will descend through the less agitated part of the liquor in the centre, down into the cylindrical vessel beneath the fire-place; and when it is judged that a sufficient quantity of it is there accumulated, the lower pipe is first opened to let in cold brine about the salt, and cause the hot brine to ascend from it, which it will do by being of less specific gravity, and then the lower cock in the archway is opened, and the salt drawn off through it into baskets, along with a portion of the brine, which is received into a proper vessel placed beneath the baskets, and is pumped back again into the boiler or the cistern.

The advantage proposed by the patentee by this form of boiler, is to prevent the salt from sticking to it, which he takes for granted the obliquity of its sides will effect, added to the action of the heat impelling the liquor, and it from them, towards the centre.

It is stated at the end of the specification, that this boiler may be heated by steam, or by heated air and smoke passing from fire-places of other boilers, as well as by having fuel directly applied to it, as mentioned; in which mode of managing it, a case should surround it of iron, or other proper materials, to confine the action of the heated medium, so as to make it have most power. And the whole concludes with the usual clauses relative to variations of shape, producing the same effect, being within the limits of the patent; and with the negation of claim to such parts of the apparatus and process, as have been before used, and are not immediately concerned in promoting the design of the patentee.

The boiler proposed by the patentee is certainly of a kind very little favourable for evaporation, both on account of its great depth, the obliquity of its bottom to the fire, and from its being covered at top from the action of the air; but if it would have the effect, which he supposes, of preventing the adhesion of saline matter to its lower parts and sides, there might be situations where fuel was sufficiently cheap, to make the additional quantity of it, which this boiler would require, less an object than the saving which would from this be produced in the wear and repairs, which we understand for the common salt-pans occasion a considerable expence.

Were the brine composed of a solution of muriate of soda alone, the boiler of the patentee would probably be little affected by adhesions; but as it always contains a mixture, more or less, of various calcareous, argillaceous, and magnesian salts, whose bases have a strong attraction to iron, as well as their acids (in which latter it is so great as to decompose some of them, particularly those of which alumine forms a part), we think the shape of the boiler could not prevent this attraction from taking place, and causing adhesion to a certain degree, which, however, would probably be a great deal less than in the common flat pans.

The use of steam in evaporating, proposed by the patentee, would certainly tend greatly to preserve the boilers, as it would prevent them from getting that high degree of heat, which does them such mischief when adhesions occur, and hardens these latter so as to make much force necessary in their removal. But this is by no means a new application of steam, several others having before used it in this way; nor does it appear, that the method proposed for this purpose would be the best; on the contrary, it seems very inferior to the mode of applying steam to salt pans, &c., for which Mr. James Smith, of Worcester, obtained a patent, about six months previous to the date of that of Mr. Parkes, the specification of which may be seen in Repertory, Vol. XLIV. p. 74, and we are also inclined to think that Mr. Smith's method of having a part of the pan for the salt to settle in, not acted on directly by the heated medium (by making its bottom project beyond the top of the steam vessel about 18 inches at every side), would be at least as effectual as the cylindrical vessel of the patentee, placed at the bottom of his boiler for the same purpose; and would be attended with less trouble, and less reduction of temperature of the brine, in removing the salt after its formation.

Perhaps in place of a figure, it may, in addition to the description, give a better idea of the shape of this patent boiler, to know that it bears a strong resemblance to an inflated air-balloon, with an upright cask fastened to its lower extremity.

Observations on the Re-building of London Bridge, with an examination of the Arch of Equilibrium, proposed by Dr. Hutton, and an investigation of a new method for forming an Arch of that description. By JOHN SEAWARD, *Civil Engineer. 8vo. 142 pages.*

MR. SEAWARD commences his work by an investigation of the most suitable curves for forming the arches of a bridge; where, in comparing the segment of a large circle, a semiellipse, a parabola, a hyperbola, and a catenaria, he gives the preference to the semiellipse, both on account of its "beauty," and because "no other curve can be so advantageously employed in forming the intrados of an arch. At the springing of an elliptic arch the curvature is considerable, and as it rises perpendicularly it affords the most commodious opening, both as a water-way and as a passage for craft."

Next to the form of the arch, the author thinks that nothing is of so much importance to the symmetry of the bridge as the situation of the points from whence it is to spring; and after comparing those of several bridges, asserts that in his opinion "no work of art can equal the beauty of a large arch, springing immediately from the surface of the water," and directs, on this principle, that in tide rivers, where the level of the water is continually varying, the springing of the arches should commence at low water mark.

The author next proceeds to examine Dr. Hutton's theorem for an arch of equilibrium, on which he makes the following remarks:—"This is the curve which the Doctor has so strongly recommended for the arches of a bridge, as being both of a graceful figure, and of a convenient form for the passage through it. I know not in what school the late venerable Doctor acquired his architectural taste, but with all due respect to his memory, I will venture to assert that the curve is any thing but graceful; it is, on the contrary, inelegant and unsightly, and is in every respect so ill adapted to form the arches of a magnificent bridge, that I am satisfied no architect or engineer, who has any pretensions to taste or judgment, would risk his reputation by introducing it in any work of which he has the management."

The author, however, acknowledges his obligations to the Doctor for the principles on which he proceeds to construct "an arch of equilibrium, having a straight horizontal boundary line, with any curve for the intrados, and any required depth of voussoir," by which we presume the arch of the bridge to which this curve is to be applied is intended, as the arc of equilibrium can have but one line, and that certainly not a straight horizontal one. As an example, he calculates this curve for the arch of a bridge, in which the curve for the intrados was to be a semiellipse, and after several pages of algebra, ascertains one which will fall within the voussoirs of the arch, and which, passing through the bottom of the voussoir at the crown of the arch, will not be far from the line of intrados at the upper part of the arch, and will only depart from it at the lower parts, and that not to any great distance; while a curve parallel to it will correspond very nearly to the line of the extrados; by which means a solid arch of equilibrium will exist in the body of the voussoirs, having so much external to it, or superfluous, in the substance of the voussoirs, as will be necessary to shape their lower parts so as to form the semiellipse required for the intrados.

In forming the voussoirs for this arch, he directs that their sides should be perpendicular to the arch of equilibrium that passes through their substance, instead of to the semiellipse, which latter mode he justly objects to, as well as to some others which have been practised; and in the 7th chapter, where he treats of the depth of voussoirs, after carefully examining this essential matter, and determining that its ratio to the span is the best that can be applied to it, states that he is "convinced that one thirty-fifth part of the span is quite adequate for the voussoirs of a large bridge, in a crowded city."

In treating of the stability of arches, the author maintains that this will depend on the mass of materials of which they consist; which may be modified, first, by increasing or decreasing the depth of the voussoirs, the weight remaining the same; secondly, by increasing or decreasing the weight, the depth of the voussoirs remaining the same; and thirdly, by increasing or decreasing the curvature of the arch, the other two particulars mentioned being the same. And to prove his position, that the stability of an arch is increased by diminishing the curvature, and thereby increasing the lateral pressure, he instances the cast iron arch over the river Wear, in Sunderland, and the centre arch of Southwark bridge, which have nearly the same span and depth of voussoir, but differ in the curvature and density; the former having a much greater curvature, and only about a third of the density or weight of materials; the consequence of which is, that the vibrations which occur in Southwark bridge are by no means considerable, while in Sunderland bridge they are what may be termed alarming oscillations.

On this subject, a little after the above remarks, the author states, that "the narrowness of the voussoirs of an arch of stone is of no consequence whatsoever, as regards its stability," which appears in direct opposition to part of his former assertions. He also observes, further on, that though an increase in the width of a bridge must be attended with a greater degree of stability, it does not follow that it would be prudent on that account to diminish the depth of the voussoir; as "it is to be presumed that over a wide bridge there will be much greater traffic, and consequently greater concussions than on a narrow bridge," a point which we can by no means allow; for, however the width of a bridge newly erected may have been determined by the expected traffic over it, when it is once formed it is quite plain that its width can have no influence whatsoever in this respect, unless it be so very narrow as to preclude the possibility of the whole of the traffic required passing over it, a case which we believe hardly ever occurred.

In the 8th chapter, on abutments and bearing piers, the chief novelty consists in the introduction of two series of notched or joggled stones in each abutment, extending quite across, and nearly in the line that the arch of equilibrium would form, if extended downwards from the upper and lower extremities of the voussoirs of the arch. Each of these joggled stones is to be prepared by cutting down a few inches of an oblong stone block, for about two thirds of its length, and thereby leaving the other third projecting; and when they are arranged as proposed, with each course lying before the projection of that beneath it, and thus assuming externally the appearance of a flight of stairs, they will be so connected that no one course can be protruded by the lateral pressure, without moving the whole mass altogether, with whatever masonry there might be erected in continuation behind it. The author, besides recommending this plan, objects to the method of radiating the courses of the abutments, by which we suppose is meant the sloping them obliquely upwards, which has been practised in some of our best bridges; but it appears that this method has not in these instances been attended with the inconveniencies which he supposes; and however we may incline to recommend his plan as good and sufficient, we are by no means convinced of the propriety of condemning the other method.

The calculation first mentioned by the author for the curve of equilibrium, was made for arches whose spandrels were to be filled up with solid masonry of the same density as the voussoirs. In the 4th chapter he gives another algebraical calculation, to determine that curve for arches with hollow spandrels, formed like those of Waterloo bridge, with eight parallel walls of bricks, 27 inches thick, covered with flat stones between the external walls, which were to be 6 feet thick, and for a bridge 53 feet broad from outside to outside, with elliptical intrados, and finds that the curve of equilibrium coincides still more nearly with the elliptical curve than that first calculated for the arch with solid spandrels, and therefore concludes that the making the spandrels hollow is particularly advantageous, not only in saving materials, but in simplifying the curve of equilibrium, and bringing it nearer the curve mentioned, which makes it more suitable for the purposes of an arch.

In page 58 the author states, that though the curve of equilibrium, or of direction, has in the investigations been assumed to coincide with the lowest point of the voussoir, at the crown of the arch, this having been done only to facilitate the computation, is not to be considered as an indispensable condition, in investigating the arch of equilibrium; and that the curve might be described from any other point in the vertical line of that voussoir, as from its middle or from its highest point.

In the first figure of an arch with this curve (fig. 14), the author has represented it as forming the extrados of the voussoirs, a method which would much facilitate the construction, the intrados being in the line of the semiellipse of the arch; but in all the other figures which follow, he has shown it as falling a little within the extrados towards the sides; and in p. 61 he has given the method, by an algebraical computation, for forming this upper curve of the voussoirs, or line of the extrados, by determining successive points within its extent.

PROPOSED BRIDGE.

The bridge which Mr. Seaward proposed to be built on the foregoing principles, was to be built of only three arches, all semiellipses, of 230 feet span, and 48 feet altitude or rise, and to spring from the level of the lowest low water mark. The voussoirs were to be 6 feet 6 inches depth at the crown of the arch; the roadway was to be nearly horizontal, and the road materials were to be 4 feet 9 inches in depth above the extrados. The width of the roadway was to be 50 feet in the clear of the parapet walls, and allowing 3 feet for the thickness of the latter, the whole breadth of the bridge, from one external face to the other, would be 53 feet. The spandrels of the bridge were to be made hollow, the roadway being supported (as in Waterloo-bridge) by eight parallel walls of brick-work, each three bricks thick; and the voussoirs, as well as the whole of the facing, was to be made of the densest granite, of 12¼ cubic feet to the ton.

The voussoirs were to be set quite dry, without any mortar or cement, and their joints, which intersected the great lines of pressure, were to be run with lead, after the masonry was set, which the author thinks would not cost above three or four thousand pounds more; and if contracted for by the builder, would induce him to take great care that the stones were well and accurately dressed, to save the expenditure of the lead.

The abutments were to be made 65 feet in length, and their height from the timber cradling over the piles, to the level of a horizontal line through the top of the voussoirs, was to be 70 feet, which would cause the cradling to be 21 feet below low-water mark, and they were to be secured by two lines of joggled stones continued from the upper and lower extremities of the lowest voussoirs to the timber cradling, as before mentioned.

The piers were to be 28 feet across, which is four feet more than those of Southwark-bridge, and eight feet wider than the piers of Waterloo-bridge. Their foundations were to be five feet lower than those of the abutments, and were to extend 14 feet beyond the face of the piers and cutwaters, which would make their areas about 105 feet long by 56 feet wide. After the coffer dam was formed in the usual manner, it was intended to drive a complete belt or inner dam of permanent cast-iron or sheet piling, exactly to the size and form of the required foundation; the sheet piles to reach 10 feet below the timber cradling, and 10 feet above; which would both secure the base from being undermined by sudden floods, and would prevent the spreading of the strata beneath the foundation, while the piles were being driven down.

The fronts of the cutwaters were to be formed of two segments of cylinders meeting in the middle similar to a gothic arch, formed each with a radius of about three-fourths of the breadth of the piers; and each cutwater was to be surmounted by a colossal recumbent figure of a river god; and the elevated pedestals above the abutment piers were to be surmounted by groups of figures.

There were to be no stairs at the abutments, the author thinking them very unsightly; and that landing and plying places for watermen would be more conveniently placed at the ends of the adjoining lateral streets.

The cornice and balustrades are not described; but from some expressions of the author, we think he preferred those of the Doric order.

The scite of the bridge was to be exactly where the old bridge stands, and a new street at the Surrey side was to be made to it from the vicinity of the Bricklayer's Arms.

Archways were to be made between Upper and Lower Thames-street, and between Tooley-street and the Borough High-street; and the communication with these two latter streets and the bridge were to be formed by lateral roads made to join the new approaches.

In some considerations on the expence of a bridge, the author gives it as his opinion, that though, for reasons which he has stated, the doctrine of large arches being more economical than small arches, is not quite correct; yet that in certain circumstances this would happen; and thinks this would be the case with respect to his proposed bridge; because the increased expence of a bridge with large arches is principally confined to the voussoirs, the abutments, and the centring, while the saving lies in the coffer dams; and he computes, his method of forming the arches would admit the voussoirs to be of such a size, that they would require little more materials than a bridge of five arches, in the same situation: and also proposes to employ the arches of the old bridge in making the centring for the new bridge, by which he asserts that the expence would be so reduced, as to be far less than what would be necessary for a bridge of five arches without this conveniency.

This work is very creditable to the author, shows that he understands his subject well, and is very competent to the construction of the fabric he proposes; which we have no doubt would have fully answered his expectations in stability and durability, had it been erected, and would have formed a magnificent ornament to the City, from the beauty and grandeur of its structure.

We cannot agree with him, however, that the property in Fish-street-hill and the adjoining streets would be little affected by his bridge, as it is evident, that by carrying the road over it horizontally as he proposed, a great part of Fish-street would be several feet below its level, and that consequently the value of the shops there and in the adjoining streets must suffer materially from this circumstance; as would also that of those in the Borough, which the elevation of the roadway would affect for a greater extent.

The bridge now erecting will not in any respect do this to so great a degree, on account of its terminating at a lower level, even after making all allowance for the changes caused by its being a little higher up the river than the old bridge; and supposing that a new street, as has been proposed, will be made from it to the Exchange, and another street from the Circus in Moorfields to join it, as a great advantage to the traffic of London, as well as a speculation likely to be profitable to its undertakers.

The remarks on Dr. Hutton's arch we think had better have been spared; the well earned fame of that celebrated mathematician stands on too firm a basis to be affected by what is said, and his work on bridges will ever be an indispensable study for the accomplished architect. We think the author must have been mistaken in supposing that Dr. Hutton meant to recommend exclusively the arch of equilibrium, cited by him, for the structure of bridges, as the learned and accurate Dr. Thomas Young expressly states, in the 2d volume of his Natural Philosophy, p. 177, that "Dr. Hutton recommends an elliptic arch" for this purpose. Besides, we have reason to suppose that there is not so great a difference between Dr. Hutton's curve of equilibrium and that of our author, as he may imagine, for having applied to them both a catenaria (which is easily done by inverting the figures and placing them upright), we found that they both corresponded with that curve so exactly, as to induce us to believe, that if the catenary curve is not perfectly the same, it differs so little from them that it might be used in the same manner, to produce equally good effects in building; the only difference between them being, that to make the chain correspond with Dr. Hutton's curve, when inverted, it must be permitted to descend lower; and for that of the author's, be stretched more tight, so that the latter may be considered as the segment of a large catenarian curve near the top, and the former as a very large portion of a smaller one, and descending much lower. As to urging experiments as grounds of belief in such matters, we think it in general perfectly fair, and peculiarly so where the catenarian curve is concerned, which in fact is one decidedly of mechanical structure, however it may have employed mathematicians in investigating its useful properties; and we here beg leave to recommend to architects, the study of what Dr. Gregory published in 1697, to prove its being the best form for an arch; in discovering which, he seems to have understood its properties better than its inventor, Galileo, who mistook it for a parabola, or than Bernouilli and Leibnitz, who made its real nature first known.

As to the beauty of the forms of arches mentioned (a point on which the author claims a decided superiority, and thrusts down the Doctor somewhat roughly), we think it is so much a matter of taste and opinion, that on so important a subject as the structure of a large bridge, having a great traffic passing under as well as over it, utility should ever have the precedence. In which view we can by no means recommend arches springing from low water mark, so highly extolled by the author, as a considerable portion of them at each side would evidently be much in the way of the barges and other craft passing up and down; and to many eyes their beauty would not be so apparent as he supposes, since the idea of a flooded river, and an obstructed passage, must be always connected with their appearance.

Besides, if an arch, springing from an elevated erection, were to be reckoned a defect in beauty, from not coinciding in the line where they join, as the author seems to suppose, what are we to think of Grecian colonnades, where the entablature forms a right angle with its supports. Yet no one ever doubted the beauty of those elegant structures.

We agree, however, with the author, in reprobating the practice of sticking up pillars over the cutwaters by way of ornament. A pillar in its place no doubt has its beauty; but to put it up where it supports nothing, and at the top of a building instead of its lower part, which is its proper station, seems about as rational as it would be for a sculptor, in admiration of the symmetry of a human leg, to place a pair of them close beneath the chin of a statue, by way of improving on nature's work. We much fear, however, that the ornaments proposed by the author for those places, and for the tops of the abutment piers, would be inadmissible at present, while the police either want power or inclination to defend matters of this nature from the mutilation to which they would be exposed, from the savage dispositions of the lower classes of our population, who delight in defacing what those of other nations protect as an honour to their country.

We will now conclude with observing, that though the author did not intend this as a complete treatise on bridge building, as stated in his last page, yet he has given so much useful information respecting it in a small compass, that the young architect, who will fully make himself master of it, will find his studies so materially assisted, that even if he extends them no farther, he will be no mean proficient in the art.

LIST OF NEW PATENTS.

George Henry Lyne, of John-street, Blackfriars Road, machinist and engineer, and Thomas Stainford, of the Grove, Great Guildford-street, Southwark, smith and engineer, for improvements in machinery for making bricks.—Dated August 23, 1825.—Six months to enrol specification.

William Parr, of Union Place, City Road, Middlesex, Gentleman, for an improvement or improvements in the mode of propelling vessels.—Dated August 27, 1825. Six months to enrol specification.

John Bowler, of Nelson-square, Blackfriars Road, Surrey, and Thomas Galon, of the Strand, Middlesex, hat manufacturers, for certain improvements in the construction or manufacture of hats.—Dated August 27, 1825.—Six months to enrol specification.

Charles Mercy, of Edward's Buildings, Stoke Newington, Middlesex, Gentleman, for improvements in propelling vessels.—Dated September 8, 1825.—Two months to enrol specification.

William Jefferies, of 46, London-street, Radcliffe Cross, Middlesex, brass manufacturer, for a machine for impelling power without the aid of fire, water, or air.—Dated September 15, 1825.—Six months to enrol specification.

Jean Antoine Teissier, of Tottenham Court Road, Middlesex, Gentleman, for improvements in steam engines. Communicated to him by a foreigner.—Dated September 15, 1825.—Six months to enrol specification.

Cathcart Dempster, of Lawrence Pountney Hill, London, Gentleman, for improved cordage.—Dated September 15, 1825.—Six months to enrol specification.

George Holworthy Palmer, of the Royal Mint, civil engineer, for a new arrangement of machinery for propelling vessels through the water, to be effected by steam or any other power.—Dated September 15, 1825.—Six months to enrol specification.

Adam Eve, of South, Lincolnshire, carpet manufacturer, for improvements in manufacturing carpets, which he intends to denominate Prince's Patent Union Carpet. Communicated to him by a foreigner.—Dated September 15, 1825.—Six months to enrol specification.

Isaiah Lukens, late of Philadelphia, but now of Adam-street, Adelphi, Middlesex, machinist, for an instrument for destroying the stone in the bladder, without cutting, which he denominates Lithontrepton.—Dated September 15, 1825.—Six mouths to enrol specification.

Sir Thomas Cochrane, Knight, (commonly called Lord Cochrane), of Tunbridge Wells, Kent, for a new method of propelling ships, vessels, and boats at sea.—Dated September 15, 1825.—Six months to enrol specification.

Charles Jacomb, of Basinghall-street, wool broker, for improvements in the construction of furnaces, stoves, grates, and fire-places.—Dated September 15, 1825—Six months to enrol specification.

THE REPERTORY OF PATENT INVENTIONS, &c.

No. V. NOVEMBER, 1825.

Specification of the Patent granted to DAVID GORDON, *of Basinghall-street, London, Esq. for certain improvements in the construction of portable gas lamps, and which improvements are applicable to other apparatus for facilitating the use of compressed gas.* Dated April 14, 1824.

WITH AN ENGRAVING.

TO all to whom these presents shall come, &c. *Now know ye*, that in compliance with the said proviso, I, the said David Gordon, do hereby declare that the nature of my said invention, and the manner in which the same is to be performed, are particularly described and ascertained in and by the drawings which are hereunto annexed, and by the following description thereof, (that is to say): My improvements in the construction of portable gas lamps relate particularly to the stop and regulating valves which are employed to retain the compressed gas within the reservoir of the lamps, during the process of filling the same; and also for the purpose of regulating the flow or escape of gas from the reservoir to the burner, in proportion as it is consumed. Fig. 1, (Pl. X.) upon the annexed drawing, represents an improved construction of regulating valve, adapted to permit the flow of gas to the burner, or to shut it off at pleasure. It is composed of two pieces of metal, A and B, which are screwed together at *a a*, having a soft metal collar, *b b*, inserted in the joint for the purpose or rendering it tight. The said collar is composed of lead, soft solder, or other sufficiently soft metal, and is firmly fixed by soldering, or otherwise, to one of the surfaces which form the joint: it is not, therefore, in danger of being displaced or injured by screwing it up tight, but produces a very tight and sound joint. The lower part of the piece, B, is adapted to screw into an aperture at one end of the reservoir of the lamp, and when the regulating steel screw, *c*, is screwed down so that its conical point enters the conical cavity formed in the piece, B, it closes like a valve, and prevents all escape of gas to the burner; but on turning the regulating steel screw slightly round by its square head, the gas may be allowed to escape through the passages, *e e e e*, to the burner, *f*, in any degree that may be desired. Previously to inserting the regulating screw, *c*, in its place, I dip it in a mixture of bees-wax and oil, which operates to fill up the threads of the screw, and thereby effectually prevents the escape of gas by its sides during the time that the lamp is burning. This form of regulating valve is found to admit of great delicacy of adjustment, and is not liable to get out of order in the course of use. The lower extremity of the regulating screw, where it fits into the metal socket, may be formed to a straight cone, as shown in the figure; or it may be shaped to a sphere or other suitable figure, and in some cases a conical or tapering screw might be employed to form the fitting part. Fig. 2 shows an improved construction of valve, to be used in filling the reservoirs of portable gas lamps. It is intended to be screwed into the opposite end of the reservoir to that which is occupied by the burner and regulating valve above described. This filling valve consists of a small conical plug of metal, leather, or other convenient and suitable substance, marked *g*, which is fitted into a conical cavity or seat in the piece of metal, C, similar to the valve of an air gun, being closed by a slight steel spring, *h*, and guided in its seat by a metal pin, which slides through a hole in a small brass cap or perforated cover, *i*, which is represented as screwed over it: D shows a brass plug, which is intended to be screwed into the lower aperture of the piece, C, after the filling is completed. The upper surface of this screw plug is furnished with a soft metal ring or collar, *b b*, (as above-mentioned) which being pressed by the force of the screw into close contact with the underside of the piece, C, effectually prevents any escape of gas from that end of the reservoir, even if the filling valve, *g*, should not be quite air-tight. Fig. 3 shows an improved construction of regulating valve for the emission of gas, which possesses the advantage of great simplicity, and at the same time is capable of much nicety in adjusting the flow of gas to the burner. In this construction the passages, *e e*, for the gas, are drilled out of one solid piece of metal, and the regulating steel screw, *c*, is tapped into the side of the same piece, in such a manner that its conical point may be caused to open or close up the passage at pleasure, and thus regulate the emission of gas at the burner, *f*. The construction of this regulating valve will appear evident from inspection of the figure, without entering into a more detailed description thereof. Fig. 4 shows another modification of the regulating valve, the chief difference being in the position of the regulating steel screw, *c*, which in this latter construction is placed in a vertical position, with its conical point adapted to close the conical aperture of the passage, *e*, and thereby impede or regulate the flow of gas to the burner, *f*. Note, either of the last described regulating valves may be employed in combination with the improved filling valve described, by reference to fig. 2. Fig. 5 represents an improved construction of stop valve, which is particularly adapted to the transferring of compressed gas from one lamp or reservoir to another, without occasioning loss during such process. It is composed of two pieces of metal, A and B, which are screwed together with a soft metal collar between them, at *a a*: *e e* represents the openings through which the gas is allowed to pass. The piece, A, has the regulating steel screw, *c*, tapped through it, being formed at the lower part with a double cone, one part of which cone is adapted to fit into a conical cavity or seat in the piece, B, and the other cone is adapted to fit correctly into the cavity in the underside of the piece, A. Now when the lower cone of the regulating steel screw is screwed or forced tight down into the conical seat in the piece, B, it prevents all escape of gas; and when it is desired to transfer compressed gas from one lamp or reservoir to another, the regulating screw, *c*, is to be turned until its upper cone fits and applies correctly into the conical cavity in the piece, A, and thereby prevents all escape of gas up the threads of the regulating screw during the process of transferring, allowing at the same time free passage for the gas from one reservoir to another, through the openings, *e e*. Fig. 6 shows another construction of stop valve for effecting the same object, (viz.) the transferring of compressed gas from one reservoir to another. It is composed of two pieces, A and B, screwed together with a soft metal collar between them, similar to the one last described; but the regulating steel screw, *c*, instead of being formed with double cones, is furnished at the extremity with a loose button or revolving cylinder, *d*, having soft metal collars, *a a*, *b b*, soldered upon the upper and under surfaces thereof, so that the underside of the said button or cylinder may be screwed down tight upon the lower passage, *e*, and thereby effectually stop the flow of gas; or by turning the regulating screw the contrary way, the upper side of the said button may be screwed up tight against the underside of the piece, A, as represented in the figure, and thus prevent the escape of gas by the threads of the screw, during the period that gas is flowing through the passages, *e e*. These valves are found to be particularly useful for many purposes connected with the filling of portable gas lamps, and are less liable to get out of order than any stop cocks which I have hitherto met with. I have now described my invention of improvements in the construction of portable gas lamps, with reference to the annexed drawing, in such manner as to enable persons conversant with works of a similar nature to practise the invention; and I hereby declare that I confine my claim of invention to the following particulars, (viz.) First, to the employment of separate and distinct valves for the entrance and exit of gas to and from the reservoir of portable gas lamps, such separate valves being constructed and combined in the manner hereinbefore described, with reference to figs. 1, 2, 3, and 4, upon the annexed drawing. Secondly, to the improved construction of the stop valves to be employed in transferring compressed gas from one lamp or reservoir to another, being provided with a double cone, or with flat surfaces furnished with soft metal, or other suitable collars, to prevent the escape of gas up the threads of the regulating screw, as above described, with reference to figs. 5 and 6 upon the drawing. I also claim the use of soft metal rings or collars, as a means of making joints tight in apparatus connected with portable gas lamps; such rings or collars being soldered, or otherwise fixed against one of the surfaces of the joint, and pressed into contact with the hard metal surface on the other side sufficiently to prevent the escape of gas without employing leather, or other similar pliable material or substance. It is to be remarked, that the figures upon the drawing are about the real size of the apparatus;* but the forms and proportions may be varied according to the circumstances of the case, as well as the materials of which the same may be formed or constructed, and without departing from the object of the invention, as hereinbefore described and set forth.

In witness whereof, &c.

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* In the engraving the figures have been reduced one half.

Specification of the Patent granted to John Masterman, *of No. 68, Old Broad-street, London, Gentleman, for an improved method of corking bottles.* Dated March 5, 1825.

WITH AN ENGRAVING.

TO all to whom these presents shall come, &c. &c. *Now know ye,* that in compliance with the said proviso, I do hereby declare that the nature of my said invention, and the manner in which the same is to be performed, is described and ascertained by the drawings in the margin hereof, and by the explanation thereof, and by the descriptions and observations hereinafter contained, that is to say:—My method of corking bottles is by introducing, either by pressure or impulse, the cork into the neck of the bottle, through a conical tube, having its smaller orifice in direct and immediate communication with the mouth of the bottle, so that the tube and the neck of the bottle may form, in effect, one continuous tube: such conical tube having its smaller orifice of such a size with respect to the cork to be passed through it, as that the sides of the cork must be compressed in passing through it, or, at least, must be in such close contact with the inside of the tube, as to be prevented from bulging out, or expanding laterally, while the lower end of the cork is entering the smallest part of the neck of the bottle. But I prefer and use the tube with the same orifice, so small, that the cork must be considerably compressed in passing through it. The length of the tube need not much exceed the length of common corks; its upper or larger orifice ought to be sufficiently large to admit, very easily, the end of the cork to the middle of the tube. Machines by which the corks may be forced through the conical tubes into the bottles, according to my said method of corking bottles, admit of such a variety of constructions, that were I to describe any one machine in particular, proper for this purpose, and claim the whole of that one alone, as constituting my said invention, the said letters patent might probably be evaded by modifications of several of the parts of that one machine: therefore, the only part of any machine for corking bottles, according to my said method, which I claim as my said invention, is the conical tube, or conical tubes therein, through which the corks are to be forced into the bottles, according to my said method. But I declare that the constructing, selling, using, or exercising, of any machine, of whatever construction, for corking bottles according to my said method, will be an infringement of the said letters patent, provided that the conical tube or tubes, as before described, and to be applied in the manner before-mentioned, enter into the construction of any such machine.

I now proceed to describe a machine for corking the ordinary quart bottles, according to my said method; in which machine the conical tubes, and the mechanism for forcing the corks through them into the bottles, are arranged in that manner which I consider the best adapted for carrying my said method into execution.

Figure 7, (Pl. X.) is the front view of the machine. Figure 8 is the side view thereof. Each figure is drawn to a scale of three inches to a foot.* The letters refer to the corresponding parts in each figure: *a* is a frame: the two sides are connected by the cross piece, *b*. Two cylindrical pillars of iron, *c c*, of similar dimensions, are fixed into the cross piece, *b*, parallel with each other; their tops are connected by the bridging piece, *d*: *e* is a four-sided bar of iron, which traverses upon the upper parts of the said pillars, at right angles with them, by means of a hole towards each end, through which *c c* pass. Each end of *e* projects beyond *c*, and terminates in the form of a gudgeon: *f f f* are what I term "the impellers;" they pass through and are fixed in the bar, *e*; their upper ends traverse through three holes in the cross piece, *d*, for the purpose of maintaining them parallel with each other: *g* is firmly fixed to *c c*, and *a a*, at such a distance from the top of the pillars, *c c*, that when *e* is raised close to the cross piece, *d*, there may be a space between the bottoms of the impellers, and the top of *g*, at least equal to the length of a cork. In *g* are fitted or formed, three conical metal tubes, (represented by the dotted lines); they are so placed with respect to the "impellers," as to have common centres or axes with them respectively. The largest tube has its top larger, and its bottom smaller, than the largest sized cork required. The smallest tube has the same relation to the smallest sized cork required; and the middle tube is a medium size between the two others. Three different sized tubes are sufficient for quart bottles, whether for wine or beer. The bottoms of the "impellers" are smaller than the lower orifices of their respective tubes: *i i*, are two levers, of equal dimensions, which work on the gudgeons at the ends of *e*. These levers are firmly secured, parallel with each other by cross metal rods, *h h*, connecting the corresponding ends of each. Thus these levers and connecting rods form, in effect, and will be referred to, as one lever: *k k* are two side rods; their lower ends work on two pins, fixed in the sides of the frame, *a*, at corresponding points; their upper ends work over the ends of the cross rod that connects the shorter arms of the lever, and which ends are made to project for that purpose: *l* is a trough, which is elevated or depressed by a wedge, *m*, acting between it and *b*.

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* The figures in the engraving have been reduced one third.

The machine, as above described, is ready for being worked.

Place a bottle so that its mouth may be under, and in contact with, that tube which is of the proper size for introducing the cork into it. I prefer that the end of the tube should be a little within the mouth of the bottle. Retain the bottle in this position by elevating the trough up to the bottom of the bottle by means of the said wedge. Then raise the impellers, by means of the lever, and put a proper sized cork into that tube in contact with the bottle;

Fig. 1.

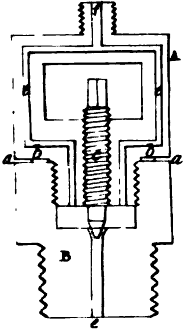


Fig. 3.

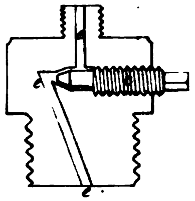


Fig. 4.

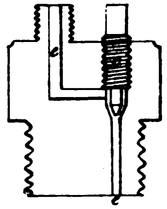


Fig. 2.

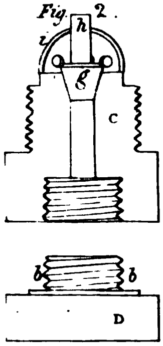


Fig 5.

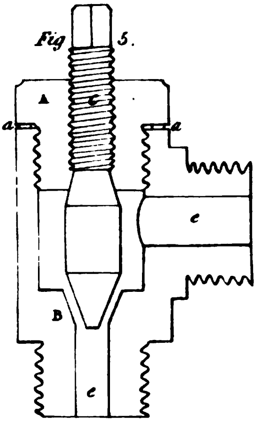


Fig 6.

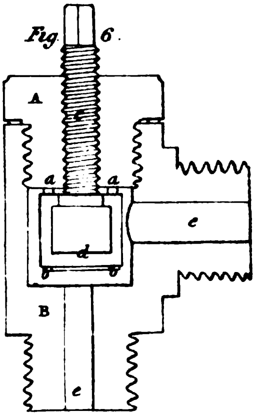


Fig 9

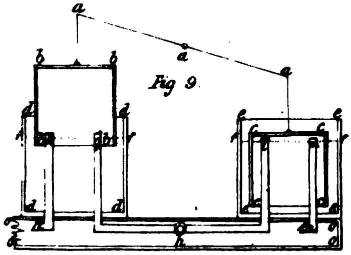


Fig 7

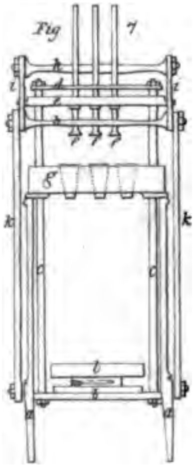


Fig 8.

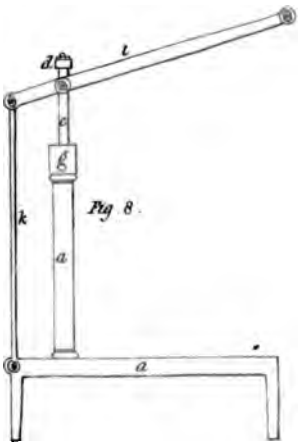


Fig 10.

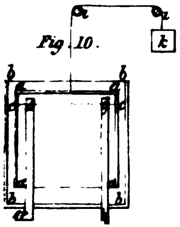


Fig 11.

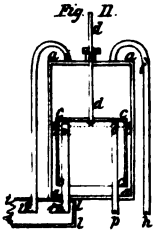
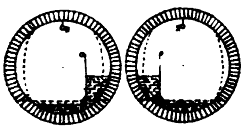


Fig 12. No 2



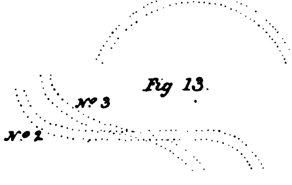
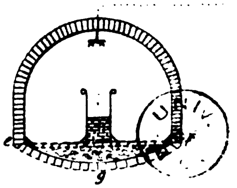


Fig 13.

Fig. 12. No 1



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then depress the lever; by which means the impeller will force the cork into the neck of the bottle. The bottle and trough are then lowered by withdrawing the wedge. The bottle is then removed, and the machine is thus ready for corking another.

By my said method of corking bottles it is evident, that common corks may be used, which (if preferred) may be introduced with the larger end downwards; that cylindrical corks may be used; that, as the corks may be introduced so far as that their heads may be within, or lower than, the top of the mouth of the bottle, shorter corks may be used, and be as efficient as the common ones; that a bottle may be corked with a larger cork than by the common method; that the time lost in biting the corks, or in crushing their ends by other means is gained; that there exists little or no risk of breaking a bottle in corking; the result of all which is, that bottles may be corked both in a better manner, and at a cheaper rate, by my said method, than by that now in use.

In witness whereof, &c.

Specification of the Patent granted to SIMEON BROADMEADOW, *of Abergavenny, Monmouthshire, Civil Engineer, for an apparatus for exhausting, condensing, or propelling air, smoke, gas, or other aëriform products.* Dated April 2, 1825.

WITH AN ENGRAVING.

TO all to whom these presents shall come, &c. &c *Now know ye,* that in compliance with the said proviso, I, the said Simeon Broadmeadow, do hereby declare that the nature of my said invention, hereinafter described, does not in any way whatsoever interfere with a Patent already granted to me, bearing date 19 January, 1824; but that the manner in which the present invention is to be performed is particularly described and ascertained as follows, (that is to say:)—In the drawings hereto annexed are represented various views and sections of my apparatus for exhausting, condensing, or propelling air, smoke, gas, or other aëriform products as aforesaid, reference being thereto had, and to the figures and letters marked thereon, as follows, (that is to say:)—My invention consists in particular arrangement of mechanism, hereafter to be described, for the purpose of exhausting or withdrawing the air, smoke, gas, or other aëriform products, generated either in the process of distillation, and thereby withdrawing the pressure from the interior of the apparatus to any flue or chimney connected with the furnace or fire-place, thereby producing the necessary draught or current of air requisite to the combustion of the fuel, and at the same time propelling the same after it has been converted to smoke or other elastic fluid, either through flues under ground, or in any way disposing of the same as may be found most convenient. This action is performed by one or more inverted vessels working in water, or any other suitable liquid, according to the gas, air, or smoke to be operated on, which will be more fully described and ascertained by reference to the drawing hereto annexed. Fig. 9, (Pl. X.) represents a sectional elevation of an apparatus where two inverted vessels are acted on by the alternate motion of a lever, from which they are suspended at equal distances from the fulcrum thereof: *a a* is the lever from which the vessels are suspended, which moves on the fulcrum at *a*, and has an alternating motion imparted to it by a steam-engine, or other adequate first mover: *b b b b*, and *c c c c*, are the two inverted vessels before-mentioned, which are perfectly air-tight, except being open at the lower extremity: *d d d d*, and *e e e e*, are the larger vessels or tanks, fitted to the line, *f f*, with water or other liquid, in which the inverted vessels, *b b b b*, and *c c c c*, respectively ascend and descend by the action imparted from the lever *a a*, as before described: *g*, *h*, *i*, is a tube or pipe, passing through the bottom or other convenient part of the vessels, *dddd*, and *eeee*, and reaching above the surface of the water line, *ff*: at the extremities, *g* and *i*, are placed valves, opening respectively towards the interior of the vessels, *bbbb*, and *cccc*, and at *h*, connected with the flue or furnace, where the action or operation of exhausting is purposed to be applied: *k l*, and *m n*, are separate pipes, passing through the bottom or other part of the vessels, *dddd*, and *eeee*, and also reaching a little above the surface or water line, *ff*. These pipes or tubes open or lead in the larger tube or trunk, *cccc*, and have valves placed at the extremities, *l* and *n*, opening towards the interior of the trunk or tube, *oooo*, which is led in the most convenient direction, as circumstances may require. To put this arrangement of my apparatus in action, it is requisite to impart motion to the lever, *a a*, as before described, which raising and depressing the inverted vessels, *bbbb*, and *cccc*, the air, smoke, gas, or other aëriform products, are drawn or exhausted during the ascent through the tube, *ghi*, from the furnace, and on the alternate descent of each inverted vessel, propelled or driven forward through the tubes, *k l*, and *m n*, into the trunk, *oooo*: the valves at *g* and *i* opening during the ascent of the inverted vessels aforesaid, and closing during the descent; and the exit or outlet valves, at *l* and *m*, opening during the descent of the inverted vessels aforesaid, and closing during their ascent respectively, thereby causing a regular draft or exhaustation to take place at the point, *h*, and a continuous blast or current of air, or other elastic fluid, to flow from and into the trunk, *oooo*. Fig. 10 represents a sectional elevation of an arrangement of my apparatus for exhausting or propelling air, smoke, gas, or other aëriform products, which I recommend in situations where power is not available, as a first mover, or where the process is of a slow and regular nature. It consists in suspending an inverted vessel by a chain or rope, either passing over pullies, or connected with a lever, so that a counter balance or weight, rather exceeding the weight of the vessel, may at all times during the operation of exhaustation act as a power to raise the inverted vessel, and produce the effect as before described: *a a a a* is the inverted vessel: *b b b b* is the tank, containing water or other liquid, to the line, *c c*. The outlet pipe is shown at *d f*, having a valve at *f*; and the inlet pipe at *g h*, having a valve at *g*: *i i* are pullies, over which a chain or rope passes to suspend the vessel, *a a a a*, and at the other end connected with the counter balance or weight, which exceeding the weight of the inverted vessel, has a constant tendency to draw up the same, and thereby produce the effect of exhaustion, as before described. In this arrangement, when the inverted vessel is full of air, gas, or other elastic fluid, the weight, *k*, must be diminished, and the pressure of the vessel itself will propel or drive forward the air or other product contained therein, by the outlet, *d f*; the valves at *g* and *f* reversing their action, as before described in fig. 9. Fig. 11 represents a sectional elevation of another arrangement of machinery, where a single inverted vessel effects a continuous tendency to exhaustion, and propels the air, gas, or other elastic vapour, as before described: *a a a a*, is a vessel completely closed and filled to the line, *b b*, with water, or other suitable liquid: *c c c c*, is an inverted vessel, suspended by the rod, *d d*, passing through a stuffing box or collar of leather, at the point, *e*, by which rod the aforesaid vessel is alternately raised and lowered, as before described, by any adequate power or first mover: *f h* is an inlet pipe, having a valve at *f*, opening towards the interior of the vessel, *a a a a*: and *i k* is an outlet pipe, with a valve at *k*, opening towards the interior of the trunk, *l l l l*, which leads the air or gas to its destination: *m n* is the outlet pipe to the interior of the inverted vessel, as before described; and *o p* the inlet pipe, having severally the same arrangement of valves as in fig. 9. By this arrangement a partial vacuum is formed by the alternating motion, imparted by the rod, *d d*, both in the inside of the vessel, *c c c c*, and in the upper part of the closed vessel, *a a a a*, thereby causing a continuous exhaustion or tendency towards vacuum in the pipes or tubes thereto connected, and leading to the furnace as before described; and also propelling the air, smoke, gas, or other aëriform product therefrom, extracted by the outlet pipes, *i k*, and *m m n*, into the trunk, *l l l l*, and thence through any arrangements of the manufacture to which the principle is applied. Having now described, with reference to the annexed drawing, my invention of an apparatus for exhausting, condensing, or propelling air, smoke, gas, or other aëriform products, I do hereby declare that I confine my claims of invention not only to the several arrangements of my apparatus, as hereinbefore described, but to the application of the principle of exhaustion caused by mechanism raising a vessel inverted in water, or other suitable liquid. The form, proportion, and also the material of which the vessels, tubes, and other parts of the apparatus are to be constructed, must depend on the nature and amount of air, gas, smoke, or other aëriform product, to be operated on governed by circumstances, without in any way departing from the object of my invention, as hereinbefore described and set forth.

In witness whereof, &c.

Specification of the Patent granted to Louis Lambert, *of* 29, *Cannon-street, London, Gentleman, for certain improvements in the material and manufacture of paper.* Dated November 23, 1824.

TO all to whom these presents shall come, &c. &c. *Now know ye*, that in compliance with the said proviso, I, the said Louis Lambert, do hereby declare, that the nature of my said invention, and the manner in which the same is to be performed, are particularly described and ascertained in the manner following, (that is to say:)—My said secret or invention consists in the employment of straw, which I prefer to free from knots by cutting them off the stems. I next submit the straw to ebullition with quick-lime in water, in the proportion of four ounces of lime to one of water, to extract the colouring matters, and to dispose it to become fibrous. I can also employ, for the same purpose, caustic potash, soda, or ammonia. It is then washed. I next expose it to the action of a hydro-sulphuret, composed of quick-lime and sulphur, in solution, in the proportions of four ounces of lime to one of sulphur, with one quart of water, in order to free it from the mucilaginous and silicious matters, so prejudicial in paper-making. I then wash it thoroughly in successive portions of water, by exposing it to the action of the paper mill, till all smell of the alkaline sulphuret is entirely removed. I then press it, and afterwards submit it to the usual operations employed in bleaching vegetable fibres, viz. to the action of chlorine, either separate, or in combination with lime, or by exposure to the open air and light upon the grass. After this it is well washed, till all the smell of bleaching is withdrawn; and lastly, it is exposed to the action of rag-engines, usually used in paper-making, in order to reduce it into pulp or paste, previous to being made into paper.

In witness whereof, &c.

Method of constructing a Tunnel of cast-iron Plates, with Flanches, placed by means of large iron Diving Bells. By MINZUR.

◆

WITH AN ENGRAVING.

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Abstracted from the Papers and Documents of the "THAMES ARCHWAY COMPANY."

IN projecting a tunnel under the Thames, at the part of the river proposed by the "Thames Archway Company," the first thing that falls under consideration is the information acquired, and the relative position in consequence.

The shaft and driftway have afforded information, that under this part of the river, to the depth of 13 or 14 fathoms, there are only to be met with alluvial beds (for none of those cut through deserve the designation of strata), intermixed with insulated concreted calcareous masses. The drift hath also further shown, that a large proportion of these beds, upon the North side, are quick, or moving sands.

The conclusion therefore must be, that the construction of a tunnel of magnitude, in the region of the driftway, if not an impossible case, may at least be judged impracticable with advantage, and therefore ineligible.

Experience hath shown, that of all the operations in mining, cutting mines in beds of subterranean mud, or quicksand, is perhaps the most difficult; and when completed, also the most difficult to keep in repair. The unequal pressure to which they are always subject, from a thousand circumstances,—from the very drainage itself, twist and warp mines cut through them in such a manner, as often, in spite of every exertion, to make them rush into ruin.

There remains, therefore, two positions, more eligible than that of the driftway, namely, either to run along the bed of the river, or to go under the driftway and the alluvial beds altogether.

In the execution of the first of these plans, a very powerful agent presents itself in opposition. The fixed law, *that fluids press equally in all directions,* would operate here with full force. This law, which is no other than the power of gravity, regulates equally the action of solids, when placed in a state of fluidity, as quicksands are; and their pressure becomes so much the greater as the specific gravity of the composed moving mass increases. Hence, in applying coffer dams, unless the piles can be driven into firm ground (an expectation the driftway does not encourage), a constant succession of materials will be thrown up within, by the pressure without, till the circumjacent bed of the river be flattened to a great distance, and till many times the bulk of the tunnel be removed; an expence which no calculation whatever can possibly assign.

Admitting, however, that difficulty to be surmountable, another presents itself of no small magnitude, and which will render mason work of no safety, and hence of no use, in constructing this plan. Great precision would be necessary, in forming the tube of the tunnel, to render its weight equal to that of its bulk of the materials in which it is to be embedded, otherwise it will tend to place itself *in equilibrio*. If lighter, it will rise; if heavier, it will sink; and if the equilibrium of the quicksands shall at any time be disturbed laterally, it will be pressed accordingly. A frost in the river, or a stormy tide, removing or adding to a bank, may produce an effect of this kind. In all these cases mason work must be fragile, must be rent, and become useless. As, therefore, no human skill can pretend to fix a point against the effect of such powerful causes, it is plain the tube of the tunnel, upon this plan, must be formed of materials both cohesive and elastic. Cast-iron plates naturally present themselves as a substitute. These, properly proportioned, constructed with flanges turned inwards, and screwed together with bolts, would bear a considerable degree of shifting, and afford more safety; but at the same time, are not altogether without risk from more than ordinary pressure. To fix these plates in their places, I would also recommend a much shorter, easier, less expensive, and more practicable mode, than by coffer dams. I would recommend the use of capacious diving bells. These I would construct of cast-iron plates also; fit them up with convenient passages for the workmen to pass out and in, and for the delivery of materials; and fit them also with metallic pipes, through which an abundant supply of air could be thrown for any number of workmen, by the power of a steam-engine. Two bells could be used, commencing in the middle of the river, and working outwards. Coffer dams might be used above low water mark; and hence the work would advance at four points at once. Of all the modes of executing this plan of the tunnel, I am satisfied the diving bell is by far the cheapest, most expeditious, and most practicable. Let the novelty of the proposition be no bar to its consideration, for I shall be ready to engage, in this manner, to perform any kind of work under water, and at any depth, with the greatest facility and safety. The project should recommend itself: it is not inconsistent with the adventures of an Archway Company. The bell is indeed not exempted from all the evils of the external pressure, described above: but they are not increased. They are diminished in proportion to the altitude of the water from the bottom of the bell to the surface, and consequently rendered much more manageable.

An advantage attending a cast-iron tunnel would be, that the whole drainage might only be leakage, which could be drawn from the tunnel itself without a separate mine, without much inconvenience.

A drawback, however, upon the above plan is, that it is deprived of that certainty, stability, and durability, which in great undertakings afford a high satisfaction to the mind, in contemplating the benefits to result to mankind and to posterity. The iron is a perishing article: accident alone may render its duration very short; and difficulties of repairing or renewing might arise to render the scheme altogether abortive. The Company, as a corporate body, should look to something more lasting. I would therefore seriously recommend to their consideration the other scheme of sinking, under the alluvial beds, into the solid stratification; or at least into such materials as are sufficiently solid, and not under the influence of the laws of fluidity, further than the water flowing from them.

In the accomplishment of this scheme, there must be neither dread nor fear of water; but proper provision must be made for drawing it. The plan of operations I would recommend as follows:—To put down the bore in the bottom of the present pit, till the solid beds or ground be ascertained; then, as the result shall recommend, to put down the pit next the river on the South side, to the necessary depth. There is no occasion to go so far from the river as the other pit at the same side of the river. In this plan the depth is taken at about 25 or 26 fathoms. From the bottom of this pit I would recommend to cut a driftway or level to the middle of the river; or, perhaps, the whole breadth. This driftway would require to be large, 7 or 8 feet high, as it must be divided into two or three divisions. The first, in the roof, for the conveyance of air; the second for a waggon way; and the third for a reservoir, lest the engine should stand at any time; or the second and third divisions might form a canal, whilst the work is carrying forward, and supersede the waggon way. The whole will afterwards serve as a reservoir, to prevent interruption in the tunnel from water; and the larger the better, to hold a number of days' supply, to allow proper time for occasional repairs upon the engines. The great work would commence at the middle, and proceed outwards to both sides. The declination would be adjusted by the depth, and which could be afforded abundantly gentle at that represented. Indeed, at any depth it could be rendered gentle, by giving a curvature, such as represented by the dotted lines, fig. 13, No. 1, 2, and 3, (Pl. X.)

Either one or two parallel arches could be constructed, as represented in the transverse sections, fig. 12, No. 1 and 2, which is the construction I would prefer when practicable. Indeed it is always more practicable than two, unless removed to a distance from one another; and in most cases should be cut at a smaller expence. The footway, elevated above, and dividing the carriage roads, may either stop at the shafts, next the river, at each side, which will be converted into staircases, or they may proceed to the end; or both. The dimensions delineated are sufficient for ordinary carriages; if larger should be wanted, the dimensions may be increased. In the section the tunnel is represented as passing in the solid strata till clear of the river. This may be necessary so far, or may not, according to circumstances. The stratification, dip and rise, are assumed merely for illustration, and meant to represent firm ground. I do not so much as know whether it is a stratified country. In parts where the ground is hard and solid, the bottom may be cut flat, as the line *ef*, in the section, fig. 12, No. I; but where not sufficiently firm, would require a flat inverted arch, *efg*, to prevent heaving or letting down. The plan of lighting is by the hydrogen gas, thorugh a tube and cocks. Lamps could be placed in the same situation.

The returning of the ends, expressed upon the plan of the Company, implies a confinement upon the surface, which may produce inconvenience. This may be obviated by the curvatures, fig. 13, as much latitude may be taken under the river; but of this a correct opinion could only be given upon an inspection of the grounds.

The advantages of easier ascent and shortness, recommended by the Company, are not qualities of this plan. But if in making roads upon the surface, these qualities are often obliged to be dispensed with, there must be much less latitude in making roads below rivers; and other advantages are acquired for outbalancing those given up. Upon this plan alone complete mason work can be accomplished, and the undertaking rendered as lasting as the pyramids of Egypt. It is in this way alone that it can be handed down with benefit to posterity.

I have accordingly neither considered increase of ascent nor of length as forcible objections; but increase of depth must undoubtedly produce increase of water, and consequently increase of expence of drawing it; and it is here where the objection lies. If the feeders now require 14 horses' power, they may at least be expected to increase to double or treble that number. To obviate this objection, I would suggest different schemes. In the first place, as I am satisfied I could draw water much cheaper than the Company, I would engage to go the depth of 30 fathoms, or more, at an expence little more than 20 horses' power, and would contract for a long period of years. This, however, is to be determined upon further information.

In the next place, the water drawn has a chance to be good fresh water, at least that from the gravel bank will. This, in such a situation, should not be thrown away; and the Archway Company might become also a Water Company, and then an ample flow would not be dreaded, but courted. For this purpose I would also contract, at a very moderate rate, to raise the water to any given height.

In cutting the tunnel in solid ground, there is also a chance of meeting with good stone, which would bring some value; and if a quarry where met with, I should show the Company how to work it with advantage. I shall not enlarge further, but remain your's,

Un Mineur.

P. S. I have not added estimates to these plans, as more information would be necessary for the first, and even then might run the risk of being very fallacious. For the second, sufficient data are not yet given; but when given, might be estimated very minutely. I would recommend to the Company to fix upon their plan, and then take estimates; otherwise they may find estimates of very little use.

Mineur.

On the Application of the Sliding-rule to facilitate Calculations of the strength of Materials. By A Correspondent.

Communicated by the Author.

It does not appear to be very generally known, that the common sliding-rule can be applied to form a table of the breadths and depths of a series of beams of equal strength; and as the operation of setting the rule for this purpose is very simple, perhaps you will have the goodness to place it before your readers.

The common sliding-rule has four lines of numbers, marked A, B, C, D. To prepare for the operation, invert the slider so the line B is next the line D. Then let the given beam be 2 inches in breadth, and 8 inches in depth. Set 8 on D to 2 on B, and the line B will show the breadths, and opposite each breadth on B, the corresponding depth will be found on D, so that the beam may be of equal strength.

Also, supposing it to have been found by calculation that the breadth, multiplied into the square of the depth, should be a known number, as 125, then set 125 on B to 1 on D, and the lines B and D become a table of breadths and depths. When the depth is the same as the breadth, the number is the cube root of 125, or of the number set to unity on D: in this case it is 5.

By means of Mr. Bevan's sliding-rule, a table of breadths and depths for beams or bars, of equal stiffness, may be exhibited. Thus, insert the slider E, inverted, between the lines A and D, and E becomes a line of breadths, and D a line of depths for beams of equal stiffness. If it be desired to know the breadth of a beam 10 inches deep, so that it shall be equally as stiff as a beam 8 inches square, set 8 on E to 8 on D, and opposite 10 on D, we have 4·1 on E, which is the breadth required.

When the number on E is equal to the opposite one on D, the number is the fourth root of the number on E, which is opposite to 1 on D. Hence we have a means of knowing the fourth root of any number at once, by inspection.

The sliding-rule is already a most useful pocket-companion for those who have intricate calculations to make, when there is neither time nor opportunity to refer to tables; and if these few hints add any thing to its utility, it will afford considerable pleasure to your most obedient,

T. ———.

On the construction of Carriage-way Pavements. By Mr. Bryan Donkin, *Civil Engineer.*

A Paper read before the Institution of Civil Engineers.

COMMUNICATED BY THE AUTHOR.

The very short period during which the pavements of this great metropolis remain in a tolerable state of repair, must have attracted the attention of all whom business or pleasure induces to traverse its streets in carriages or on horseback. The holes and inequalities with which every thoroughfare is filled almost immediately after it has been paved anew, whilst they occasion intolerable jolting, destroy carriages prematurely, and, by making the footing for horses very insecure, render two-wheeled vehicles and horseback extremely dangerous.

All are ready enough to detect the immediate cause of the speedy derangement of our pavements, in the immense number of heavy waggons, carts, and drays, which constantly crowd the principal streets; few, however, think of looking for causes more remote, which are within the reach of remedy, and which especially deserve attention, as mainly allowing the immediate cause to exert its destructive influence. The subject of pavement, however, is too important to have escaped the notice of engineers entirely. It has been investigated by some, and various improvements in the method of paving have been proposed; but from objections taken either to the nature of materials used, or the expence to be incurred, none of them has ever been generally adopted.

As the merits of the method of constructing carriage-way pavements I shall propose, will be best appreciated after the causes which render the plan usually pursued inefficient have been made known, I shall here explain these briefly.

In most of our streets the pavement lies on a soft and yielding bed; in several I have seen it bedded upon the vegetable earth, or natural soil of the place; and in others, where it has required to be raised to the original level from which it had gradually sunk, I have seen it laid upon sand. This last, however, is generally employed in too small quantity to be of any use; for sand, though certainly a convenient material for bedding, and supplying a more durable support than earth, is still very far from what is requisite; indeed, is altogether useless, if sparingly employed.

Again, paving-stones of very irregular shapes, and of all dimensions, are generally laid indiscriminately together.

1. Varying universally in depth, the surface upon which they are to be laid must necessarily be prepared either by digging out or adding a quantity of earth, as a large or a small stone happens to be taken up by the paver. The very nature of this operation opposes the practicability of giving an equal support to every stone, or by any subsequent ramming of effecting this, if regard be paid to uniformity of surface.

2. It is a very common practice to lay a pavement without any attention to the relative size of the stones; two stones, however widely their areas differ, are frequently placed side by side. Now, the small stones opposing less resistance to a passing weight than the large, are soonest, as they are most easily, driven down, and the surface of the pavement is thus rendered uneven.

But supposing, for argument sake, that the earth upon which a pavement is laid has been previously well rammed when dry, the stones selected of one size, and carefully bedded (which would undoubtedly make a better pavement than is generally seen), this is not yet enough; for the earth being spongy and absorbent is softened in wet weather, and no longer yields a firm bearing to the stones; these, constantly exposed to heavy weights and to blows from carriage-wheels, are put into motion and churn, or pound the soil beneath, till it becomes a pulpy, semifluid mass, easily displaced laterally, *i. e.* from the under surface of one stone to that of another, or upwards through the crevices between the stones into the street. One stone thus acts as a forcing-pump; for being depressed itself, the mud is either driven from below it laterally under the neighbouring stones, by which they are raised, or it is forced up through the crevices to the surface of the pavement.

Thus it is that the pavement so soon becomes uneven and full of holes, and at the same time covered with mud, to the great annoyance of passengers generally. Few are aware of the source whence the vast quantities of mud are derived which we see daily taken from the streets; but the truth is, the foundations of our pavements are actually carted away as a nuisance.

So much for the causes which will preclude the idea of durable pavements being formed, so long as the circumstances under which they are constructed remain unchanged. Let us, therefore, turn to the chief objects of attention in making a pavement, and the best means of securing its permanent good condition. These are,

1. Uniformity of surface.
2. Durability of materials.
3. The relative and absolute size of the stones.
4. The form or slope of the road.

In the first place it is evident, from what I have said above, that no permanent uniformity can be expected in thoroughfares for heavy carriages where the paving-stones are laid upon earth reducible to a semiliquid mass by every shower of rain, and where large and small stones are indiscriminately used together. I should therefore recommend, that a substratum be formed of more unyielding materials, upon which the paving-stones may be laid. For this purpose I propose flint, limestone, granite, or any other hard stone, broken into pieces about an inch or an inch and a half square, and laid to the thickness of from nine to twelve inches, according as the nature and quantity of traffic expected on the intended road may determine.

I should also recommend, that previous to laying on this substratum of broken stones, the earth, by ramming or otherwise, be rendered as uniformly hard and compact as possible, and its surface brought exactly to the shape intended to be given to the road when completed. Having done this and laid on the broken stones, whose surface must also be made smooth and even, I would cover the whole with a layer of fine gravel or coarse sand, which would facilitate the proper bedding of the paving-stones, and would also tend materially to fix, and to render the broken stones less liable to be moved by any pressure from above.

Secondly, The durability of the pavement, as far as it is affected by actual wear, will depend entirely upon the hardness of the stones employed. Granite and whinstone are almost universally used in London, and both wear well, but the whinstone is the more durable.

Thirdly, When a pavement is to be laid upon a yielding material, it is of great consequence that the stones be as nearly as possible of one size in the same neighbourhood, and that there be no sudden transition from large to small, or the contrary. When a difference of size exists among the stones, the small should be picked out and laid together, separate from the large. Between parts of the street laid with the largest stones, and others laid with the smallest, there ought to be several courses gradually diminishing in size. This would prevent any abrupt junction between the large and the small.

On paving over a bed of broken stones, such attention to equality of size would certainly be of less consequence; yet, as no artificial substratum will be perfectly unyielding, and as uniformity of structure will most effectually contribute to permanent uniformity of surface, I should insist upon its never being lost sight of.

The absolute dimensions of the stones for paving may be determined by considering whether they are to be laid upon a very yielding material, such as earth, or upon one more firm, such as broken stones. Let us consider the stone in its three dimensions, its breadth, its length, and its depth; by breadth, being understood its dimension parallel with the line of the street, and by length, its dimension across the street; the depth requires no explanation. The breadth of the stone is in all cases to be determined and regulated, first, by what is necessary to a secure footing for horses; and secondly, by the due size of the base. To comply with the first of these conditions, we may assume seven inches as the greatest breadth which may prudently be given, even when the stones are laid upon earth. If upon a firm substratum, such as I have proposed, however, I believe about five inches will be found to give the best footing, and also to oppose less resistance, and occasion less jolting to carriage-wheels, than the broader ones.

If the length of a stone exceed its depth it lies insecurely, being liable to be depressed, first at one extremity, and then at the other. By this the neighbouring stones are loosened, the earth below is churned into a pulp and forced upwards, the stone sinks itself, and destroys the even surface of the pavement.

Although it be scarcely possible to prevent entirely the *depression* of the stones, change of position in any other direction ought not to happen; to whatever extent a stone is driven down, or upon whatever point pressed, it ought to remain parallel with its first position. To effect this, the *depth* of the stone ought to be its greatest dimension; it then not only receives greater lateral support from the stones around it, but, presenting more numerous points of contact, opposes more effectually a direct depressing force, as the neighbouring stones are then made to bear a part in the resistance.

Assuming a general relation between one dimension of the paving-stone and another, I apprehend that if the breadth be taken as 1, the length may be 1½, and the depth from 2 to 2½, according to the wear it may be exposed to.

The absolute size will then be five inches broad, seven and a half or eight inches long, and from ten to thirteen inches deep.

Fourthly, The ease of draught only considered, it is demonstrable, that a perfect plane is the best shape for every road. But as the water must be got rid of, it has been found expedient, particularly in plains and on levels generally, to incline the roads to one side, or to round and elevate them in the middle. This practice has been carried much too far; a very slight inclination suffices to drain off water; and, although a great reformation has of late been effected on our turnpike roads, the extravagantly high rounded pavement still remains a dangerous evil in many of our streets. Some, I know, conceive that the arched form gives greater durability; the pavement, in their opinion, possessing the properties of an arch, each stone deriving support from its neighbours. That this, however, is mere assumption, is shown by the pavements so formed not proving more durable than those which have been laid nearly flat. The rude shape of the stones employed for paving is of itself argument unanswerable against the utility, as it is against the possibility of making a proper arch of the pavement. But even admitting the arch form to answer in some measure the end proposed, it would afford no compensation for the accidents it occasions to horses and passengers, and ought therefore to be entirely abolished.

The advantages which would result from the method of paving upon a substratum of broken stone, are,

1. Greater durability to the surface of the pavement.
2. Greater security both to passengers and horses.
3. Greater ease of draught to horses, and great diminution of jolting to persons riding in carriages.
4. Carriages would not be so speedily shaken to pieces on an even as on a rough pavement.
5. The streets would be almost entirely freed from the noisome mud with which they are regularly covered at present after every shower of rain. BRYAN DONKIN.

Design for a Bridge of one Arch, of 600 feet span, in cast-iron, proposed to be erected across the river Thames, near the Tower. By MR. JOHN SEAWARD, *Engineer, Poplar.*

Communicated by the Author.

WITH A PLATE.

THE accompanying sketch of a bridge of one arch, in cast-iron, of the unusual span of 600 feet, was designed to be erected across the river Thames, just below the Tower Wharf, where a road already exists in a line nearly with the Minories; on the Southwark side of the river, it being proposed to form a new road in as direct a line as possible to the Bricklayers' Arms, in the Kent Road.

The project of building a bridge of one arch across the Thames, high enough for ships to pass under, is nothing new. A plan of a similar kind was proposed many years ago, by Mr. Telford, for the rebuilding of London Bridge. The present plan, however, is supposed to possess some novel features which I apprehend are not undeserving the notice of the scientific and practical bridge builder.

The arch, which will give a clear water way of 600 feet, will spring about 10 feet above high-water mark, and at the crown will be 80 feet above high water, which it is presumed will be sufficient to admit the small vessels under, which usually go above the Tower, without striking their topmast. The curve of the arch is not intended to be any portion of a circle, but is proposed to be a flat segment of an ellipse. My reason for adopting the latter instead of the former curve, is an opinion that flat segments of circles have *a very bad effect* when employed for the arches of a bridge. I shall not dwell upon this point now, but beg to refer the reader to a small work which I have lately published, on the Rebuilding of London Bridge, wherein this subject is particularly adverted to.

The next important feature in the proposed bridge is, that although the arch will be entirely composed of iron, it will be so constructed, that when painted it will have all the appearance of regular masonry, and will thus harmonize with the stone-work of the abutments. To accomplish this, the whole of the ribs and spandrels are proposed to be covered with plates of iron, with projecting mouldings and cornices, and joints struck to imitate stone voussoirs and regular masonry.

Each rib it is proposed shall be formed of 31 separate pieces, as shown at G, fig. 3, which is the section of a half arch. The pieces are to be formed as shown at E, fig. 5, and will weigh about 14 tons each: then to be connected together by tie-beams, and further secured by a double series of crosses, extending over the whole of the arch, both on the upper and lower side, as shown in the plan of the half arch, fig. 3. The road to be formed on cast-iron plates, in the usual way.

Few persons, who have paid any attention to the construction of bridges, but must have observed what a great impediment is caused to the navigation of the river by the centring required for large arches. In the present case, however, this serious evil will be entirely obviated, for it is proposed to erect the whole of the arch without any centring whatever, by which the river will be freed from all obstacle. To accomplish this desirable object, it is intended to carry up the abutments of masonry to the required height, upon which are to be constructed towers, as B, fig. 3, 40 feet high, of timber framing, sufficiently strong. To the top of these towers wrought-iron rods, A, will be attached, to support the different pieces of the ribs, G, as they are put together, commencing at both the abutments at the same time, and proceeding simultaneously towards the centre of the arch, which being completed, the rods and towers can be removed, and the remainder of the work proceeded with. C, C, are back stays of strong wrought iron, to support the towers: D is the coffer dam, employed in getting in the foundation of the abutments.

In the construction of iron arches, a very heavy expence is incurred in the necessary chipping and filing all the joinings and connexions of the cast-iron. The whole of this tedious operation will be dispensed with in the proposed work. It is intended to put all the castings together in the state they come from the foundery. All the joinings are then to be carefully loomed round, and the interstices filled solid by melted cast-iron, poured into the joints; a portable cupola or furnace is to be constructed on the arch for this purpose. As all the joints will be made of a dove-tail shape, with sufficient space for the melted cast-iron to flow round, the whole arch will thus be united in the firmest manner, and may almost be considered one entire piece of casting, from one abutment to the other.

The quantity of cast-iron required for the whole of the arch, is estimated at 6500 tons. To this must be added the weight of the road materials, and all adventitious loading, which may be taken at 3500 tons more, making altogether about 10,000 tons. The horizontal thrust upon each abutment, caused by this immense load, will be about 10,500 tons, which is nearly three times the horizontal thrust of the centre arch of the Southwark Bridge. To resist this immense lateral thrust, it is proposed to construct the abutments of great size and solidity; and in which I propose to adopt a novel plan for connecting together the different courses of masonry, the particulars of which will be found detailed in the work above alluded to.

As the elevation of the roadway over the bridge will be very great, the approaches will be formed by inclined planes, supported on arches, the inclination being no where more than about one in thirty.

It should here be observed, that a short time ago it was proposed to erect, on the same scite, a bridge on the suspension principle. Whether this plan is abandoned or not I am unable to say; but I confess my preference is decidedly for a bridge of cast-iron, similar to the one here proposed. That suspension bridges are in their way very admirable structures, is unquestionable; and in unfrequented parts of the country, where a cheap substitute for a bridge is required, they may be judiciously introduced; but for a great and crowded metropolis, they do not appear to be quite so eligible. The importance of the first city of these realms requires the public structures to be more substantial and durable.

The bridge now proposed, it is presumed, would have a very ornamental effect. Nothing appears so well calculated to adorn the port of London, or produce an imposing effect to persons sailing up to the metropolis. Of its utility there can be little question, when we observe the very crowded state of London Bridge. There are evidently some other channels of communications wanted between the Eastern and South parts of the metropolis, none of which appear to me to possess higher claims to patronage than the proposed bridge.

REFERENCE TO THE PLATE (XI.)

Fig. 1. An elevation. Fig. 2. A plan. Fig. 3. Section of half arch and abutments. Fig. 4. Plan of half arch, &c. Fig. 5. Part of spandrel. Fig. 6. Section across *a* to *b*. Fig. 7. Tie-beam. Fig. 8. Crosses.

On the Causes of the Hardening of Lime of various kinds.

By M. Hassenfratz.

The different species of lime are in two opposite situations—when they are exposed to air, and when immerged and exposed to the action of water. We will first examine the cause of lime hardening in air, and afterwards that of its becoming hard in water.

If we attentively examine, 1st, what are the results and the progress of the action of air on slacked lime; 2dly, how the banks of limestone have been formed, which owe their production to water, we shall be convinced that the first effect, which immediately takes place on the lime, is to reproduce carbonate of lime, and that by the facility with which lime attracts from the air, and seizes on carbonic acid. After having observed what takes place in this circumstance, we will examine how the layers of calcareous stones are formed in the water.

All the kinds of lime which we have slacked, and which have been afterwards exposed to the air, contained carbonic acid, which they attracted from the atmosphere; but its quantitv in them was very various. Three causes contributed to determine it,—1st, the state of the air which may contain it in larger or smaller proportions; 2dly, the form and the size of the pieces, the heaps of the slacked lime, and their situation relative to the air; 3dly, the nature of the lime and its degree of purity.

1st, We may conceive that lime slacked in water, that is to say, hydrate of lime plunged into an atmosphere, ought to absorb it more easily as its proportion is larger. Atmospheric air contains commonly but some hundredth parts of carbonic acid; lime saturated with it holds 0·45 of its weight. These two substances, air and lime, have an affinity for the acid; they seize on, and mutually take it from each other, until their affinities are in equilibrium. That which has the greatest affinity for it takes it from the other; but in proportion as that of the two substances which has most affinity for it takes it from the other, its affinity for it diminishes, and that of the other increases. If that of the first is not renewed, it arrives soon at a point where the two affinities are in equilibrium, and there remains no more carbonic acid to be taken up by either. If the substance which has less affinity for it be continually renewed, as takes place with atmospheric air, the equilibrium of affinity takes place, but not speedily; in fine, a time comes when the lime can take up no more. To arrive at this equilibrium, must the quantity of carbonic acid be that which is found in pure carbonates of lime? This is very probable, but there is nothing to prove it. Nevertheless, in very ancient mortars, which have been analyzed,

Fig. 1.

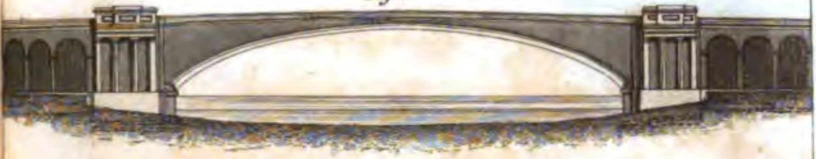


Fig. 2.

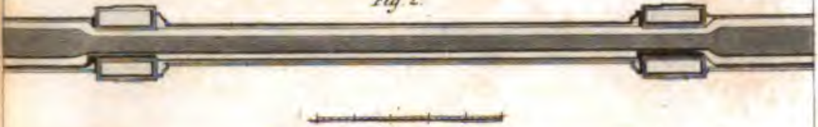


Fig. 3.

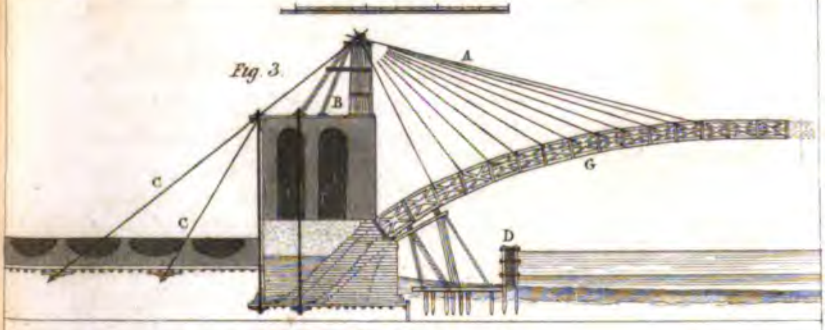


Fig. 4.

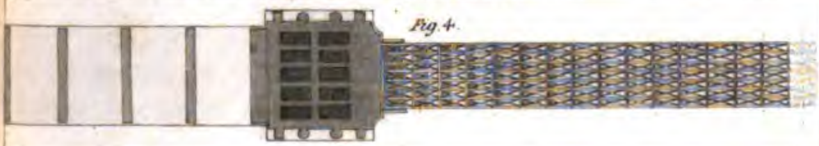


Fig. 6.

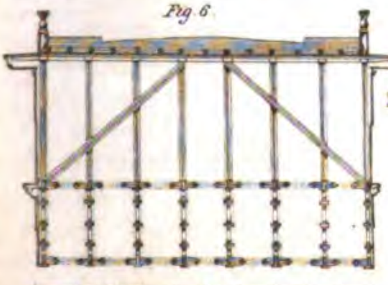


Fig. 5.

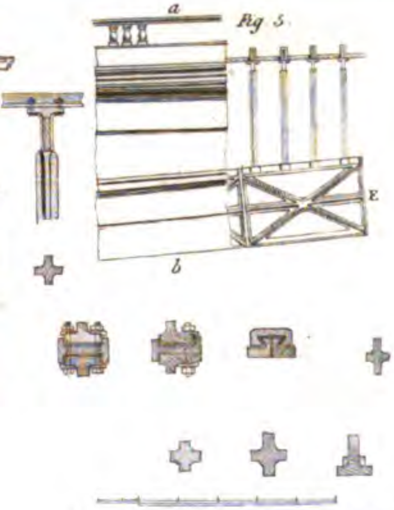


Fig. 7.

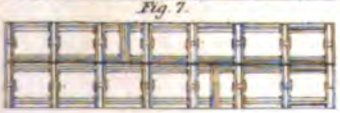
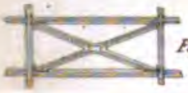


Fig. 8



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there is often found the same proportion of carbonic acid which exists in carbonates of lime. M. Darcet, for example, has analyzed a Roman cement (Annales de Chimie, vol. LXXIV. p. 315), which produced 0·41 of carbonic acid to 0·563 of lime, which is very near the quantity proper for its saturation, which is 0·45 to 0·55 of lime.

As the carbonic acid combines immediately with the exterior surface of the pieces of hydrate of lime, the air ought to yield much acid to the external layer of the lime before this acid could arrive at the second layer, and it could not reach the third layer but in proportion as this drew off the carbonic acid from the second, which in its turn extracted it from the first. It is only by the difference of the affinity of each layer for carbonic acid that they reciprocally take this substance from each other; and as the layer which has less of this acid ought to have a greater affinity for it than that which has more, it may be conceived how this filtration of the acid takes place, and likewise how much time it would require to penetrate a layer of a small thickness. M. Vicat having in this manner exposed quadrangular prisms of lime to the action of the air, has observed that after 18 or 20 months of exposure, the regenerated layer was only some millimetres in thickness. Wherefore, as a mass of lime of but a few thousandth parts of a metre in thickness, which is that of the layer which had been saturated, could be regenerated in that time, it is only necessary in order to completely reproduce carbonate of lime, to reduce pure quick lime into very small plates, of only a few millimetres in thickness; but as the prisms on which M. Vicat made his experiments were exposed to dry air, it might happen, if they had been exposed to moist air, this moisture would have favoured the penetration of the carbonic acid, and that a greater thickness would have been regenerated.

With regard to the nature of lime, and to its degree of purity, experiments have been made by Smithson Tenant, on the proportion of carbonic acid absorbed in the same time, and under the same circumstances, by lime produced from pure carbonate of lime, and from the carbonate of magnesian lime. He has observed that pure lime, exposed on the earth to the action of the air, and to all the vicissitudes of the atmosphere, had regained, at the end of three months, 0·8 of carbonic acid, while magnesian lime, composed of three parts lime and two of magnesia, had only regained 0·42. Mortar made with pure lime had absorbed, at the end of 23 months, 0·63 of the carbonic acid, which its carbonate contained; and mortar, made with magnesian lime, had only absorbed of it, at the end of three years, but 0·45, and at the expiration of eight years, 0·47. These results lead to the belief, that pure lime absorbs carbonic acid with more facility, and in greater quantity, than when it is mixed with other substances. As to the rest, the few experiments made hitherto on the proportions of carbonic acid absorbed by pure lime and by poor limes, prevent any satisfactory conclusions from being made, and we must wait until new experiments add new facts to the small number which have been as yet collected.

From observations and experiments made to the present period, on the absorption of carbonic acid by limes and mortars employed in buildings, it would be difficult to conclude that their hardening proceeded only from the carbonic acid, combined with the lime. Besides, the analysis made by M. Darcet, of a very ancient mortar of Sarrebourg, which only gave 0·294 of carbonic acid, with 0·426 of lime, while there ought to have been 0·33 for its saturation; and the analysis of the mortar of magnesian lime, made by Smithson Tenant, which in eight years had only taken up 0·47 of the carbonic acid necessary for the reproduction of the carbonate, although this mortar was taken from the outside, seem to prove that it is only with great difficulty, and after a very long period, that lime in buildings can become combined with the carbonic acid necessary to regenerate the carbonate of lime; thus, every thing leads to the belief that another cause acts powerfully on the prompt hardening of limes and of mortars exposed to the air. Moreover, as the carbonic acid combines with the surface, this surface becomes hard, and keeps the mass of lime of the same dimensions which it had at the moment of the combination; and as the lime in hardening diminishes in bulk, it follows that it ought to form, at the time of the internal hardening, cracks and clefts, like clay dried quickly in the air, which cracks render the lime brittle, of little tenacity, and even friable.

We are still ignorant in what manner *oxigen* acts on lime; but every thing leads us to believe that some action takes place, since, according to the experiments of M. Treusart, colonel of engineers, various species of lime, both fresh from the kiln and slacked, being exposed beneath glass jars to the action of atmospheric air, that which was dry, and not slacked, absorbed but a very small portion of the oxigen of the air, while the lime which was slacked and moist absorbed a large quantity.

Let us now examine the manner in which the beds of carbonate of lime, which are formed in water, have been able to acquire the degree of hardness which they possess.

As there are different theories on the formation of the beds of carbonate of lime, some attributing them to fire, and others to water, we will only at present consider the beds of calcareous stone, which bear evident marks of their aquatic formation; that is to say, which contain either marine or river shells. These stones very generally lie in horizontal beds, which are separated from each other by clay, or various other substances in a soft and unsolid state.

We may divide these sorts of calcareous stones into two species, the chalks and the coarse limestones; that is to say, having grains more or less coarse. Some, however, as the stone of Chateau Landon, lias stone, &c. have smooth fracture and a fine composition. Their hardness is also extremely variable, from chalk and the tender stones, which may be broken by the hand, to those which are very hard, very firm, and which are only broken by a considerable blow. This hard variety, according to the experiments of Rondelet, bears between 9616 pounds (as the *Cliquart* of Vaugirard), and 595 (as the *lambourde* of Montesson); which weights were used in crushing a rectangular prism of two inches every way.

What may appear extraordinary to those who have not observed the order of the superposition of these sorts of stones is, that chalk, the most tender stone, is the most ancient; it is placed in every soil below the coarse limestones and building stone; a bed of clay, in many places extremely thick, separates it from the harder and less brittle stones, which proves that it has been deposited many ages before the other sorts. To which we will add that, as all these stones contain marine shells, it is evident that they were formed beneath the sea.

Among the means which nature has employed to produce these calcareous stones, we may distinguish three. 1st, Carbonate of lime, which has been held in solution in the water, and which has been precipitated from it gradually. 2d, Calcareous earth, which has been carried off and held in suspension in the water, and has been afterwards deposited. 3d, The waters have held calcareous stone both in solution and in suspension, and have deposited both, either at the same time or successively.

1st, We know that water acidulated with carbonic acid dissolves carbonate of lime, and that it abandons it in proportion as the superabundant carbonic acid evaporates. The stalactites and the stalagmites, which are formed in grottoes, are only produced by acidulated waters holding carbonate of lime in solution. These waters are filtered through the materials of the vaults of these cavities; the acid evaporates, the carbonate of lime, abandoned, adheres to the surface which the water has moistened, and thus forms by accumulation those beautiful columns of stalactites and stalagmites. When these waters, acidulated and saturated with lime, pass out through apertures, and run off exposed to the action of the air, the ground beneath becomes covered with solid layers of carbonate of lime, more or less thick. Finally, if these aerated waters, saturated with carbonate of lime, collected in large quantities, form basins, or run off in the form of rivulets, they deposit solid carbonate of lime on their bottoms, and on the solid substances plunged into them; they thus produce incrustations more or less beautiful.

It is possible that chalk owes its formation to a similar cause; the fineness and the whiteness of its consistence give reason for this supposition. The solutions of carbonate of lime might be brought down by the rivers into the sea, where, mixed with those of this vast basin, for a certain distance from the coast, the carbonate of lime would be deposited in the whole extent in a very fine powder, in proportion as the dissolving acid was evaporated: and other solvents might have produced a similar effect.

But this cause of the precipitation, and of the deposition of carbonate of lime, could only endure for a certain space of time, after which it would cease, either from the dissolving aerial waters becoming exhausted, or from the masses of carbonate of lime being worn away; then the waters being only loaded with clay which they held in suspension, would become equally extended and mixed with the water of the sea, where they would slowly deposit this earth; and the clay thus deposited has produced the considerable beds of plastic clay which cover the masses of chalk.

As these chalks are not always very pure, and some of them, as those of Meudon, contain magnesia, and as others of them contain clay, and others of them, finally, silex, it is possible that those other earths might have been held in solution or in suspension in those same waters, and that they might be precipitated at the same time with the carbonate of lime. The waters of the sea contain at the present time, in solution, the muriates and sulphates of lime and of magnesia, and of other bases.

As to the calcareous stones and the building stones, which are placed above the masses of plastic clay, every thing leads to the belief that they have another origin; the coarseness of the grain of the composition of most of them gives reason to suppose that these substances have been carried down by the waters, and precipitated by the repose of the mass.

2dly, At distances more or less great from the coasts, the waters of the sea might wash away and carry off, in their movements, fragments, and calcareous sands. The waters of the rivers, in throwing themselves into the sea, might also carry with them calcareous sands. These waters, mixed with those of the sea, have been transported along with them in the movements and currents to which they are subject. The above materials might be deposited, as those of the rivers, in some places in large grains, in others in fine grains, and in others in mixed grains. It is thus that sands, more or less coarse, or more or less fine, are still deposited at the bottom of the sea; but this does not, however, explain their consolidation, or the hardness which the stones have acquired.

We may moreover conceive, that the hardening of the grains of calcareous sands, thus deposited, is occasioned by the affinity of the water for the fragments of the calcareous stones, which it moistens, and to which it adheres with great force; and that a species of paste, or of mud, formed by the finest dust, shall have filled the intervals which the grains, more or less coarse, have left between them, and shall have formed a species of cement or earthy mortar. If afterwards we suppose that, by the compression of the water and of the other masses of stone, deposited one above another, the layer of water placed between the particles, whether of the grains, or of the mud, has been successively diminished, we may conceive it reduced to a thickness so very small, that the film of water interposed, which we may consider as the water of cohesion, and assimilate with the water of crystallization, shall exercise its action on the two surfaces of stones brought close together, and effect, in this manner, a cohesion more or less strong. It is thus that we make to adhere to each other two plates of glass well polished, in moistening them slightly, and compressing them strongly against each other. It is also by a similar mechanism that clay, beaten together or kneaded, acquires hardness in drying; that it diminishes in bulk by the approachment of its particles, and diminishes the thickness of the film of water which adheres to each of them. If, after drying them slowly, we expose the masses of clay to the fire, and evaporate a part of the water which they contain, the masses of clay diminish in bulk, and the particles adhere, in proportion as the film of water decreases in thickness. The diminution of the thickness, and of the force of cohesion of the particles, increase until all the water is evaporated. In this circumstance the particles being brought sufficiently close together for the exercise of their mutual affinity, the force of cohesion may be thus reduced to the simple action of the molicules, and arrive in this manner at its greatest strength.

Probably a similar effect takes place in these sorts of stones in taking them from the quarry; the force of adhesion of the particles may be attributed in part to the water of cohesion, that is to say, to the thickness of the film of water which separates them, and to the action of the molicules on each other. In moistening the stones, we increase this thickness of the films of water, and we diminish the force of cohesion; in heating them without disengaging the carbonic acid, that is to say, in drying the stone, we diminish the thickness of the films of water, and increase the force of cohesion and the hardness. But if we raise the temperature sufficiently to evaporate the carbonic acid with the water, considerable cavities must be formed, since the substance loses 0·45 of its weight. If its volume were diminished in the same proportion, that is to say, if it were only 0·55 of its former bulk, the particles would be brought still closer together, and, by this approachment, the force of cohesion of the particles would be considerably increased: but the bulk being commonly diminished only a tenth, the particles ought then to be still at a great distance, and leave considerable interstices in the mass. However, even at this distance, the solidity of the lime is very great, and sometimes even greater than that of the stone that produced it. If the lime had retained the bulk of the stone, and the mass had still remained solid, we might attribute the first solidity solely to the cohesion of the particles; but as it has been diminished in bulk in the calcination, and as the particles are brought closer together, we may attribute in part the hardness of the stone to the action which the water exercises on its particles; for the water formed only a small part of the substance disengaged. Every thing then leads us to believe, that it is to the evaporation of the water which separates the particles that the small diminution of the bulk is due, and that the disengagement of the carbonic acid has principally contributed to render the density less great.

We may equally attribute the formation of chalk to carbonate of lime extremely divided, suspended in the water, and precipitated by the repose of the masses, and then compressed by the mass of water lying above it, which pressure would cause the water to pass out that was more than was necessary to effect the cohesion of the particles. We may every day observe a similar result to occur in the fabrication of whiting, or Spanish white. The chalk, divided, washed, and suspended in the water, becomes precipitated, and is united at the bottom of the reservoirs of water, and there forms a mass, the particles of which have a sort of cohesion. This precipitate is not left a sufficiently long time to cause it to contract a solidity as great as that of chalk, and, besides, the pressure of the column of water over it is not so considerable. This paste is taken out of the reservoirs, where it has been precipitated, still soft; rolls are formed of it, which are exposed to the action of the air; it becomes dry in consequence, and the whiting, by the evaporation of the water, acquires some little solidity, hardness, and resistance. If, during the drying, this paste of chalk had experienced a continual pressure, which would have obliged its particles to have approached each other with more force, then the chalk would have acquired a much greater hardness, of which we have satisfied ourselves, by drying pastes of chalk and of calcareous stones, which we have pulverized and reduced to the state of mud. Putting this mud into vessels, and covering them with a weight sufficiently heavy to compress the mass constantly during the drying of the coarse calcareous stone which we had pulverized and washed, the troubled water being decanted, gave us, on the repose of the masses, a very fine paste; which paste, dried by itself, and exposed to a constant pressure, gave us a stone pretty hard, analogous to the tender calcareous stones, of a very fine grain, or very fine composition. This paste, mixed with the powder of the same stone, in grains more or less coarse, and submitted likewise to a constant pressure while being dried, produced also, after six months' drying, a stone tolerably firm and hard, but, however, a good deal less hard than the stone which had been powdered. But in this case we had not the benefit of the pressure, continued for ages, which have passed away, since the precipitation and the deposition of the sands, and of the calcareous powders.

3dly, It might be possible, and even probable, that carbonate of lime in solution should be precipitated at the same time with carbonate of lime in suspension, and that this first carbonate of lime had served as a cement, and had contributed to reunite the suspended particles; but on the other side we have no reason either to admit or reject this mode of formation of solid mortars, if it be not the difficulty of conceiving that this carbonate held in solution, in abandoning the powder of the carbonate of lime, carried away equally by the water, could be sufficient to produce such an effect.

Belidor speaks of an analogous formation, in vol. IV. p. 173, of his Hydraulic Architecture. "In proportion as the beds of stone have been formed," says this excellent engineer, "the sea covers them with its mud, and with an immense number of small shells, which become attached to them, without speaking of the sand which is deposited in their interstices. All these things together cause a concretion, which at the end of some time occasions the stones to unite to one another so as to form only one single body, like that of masonry, of which we have many examples. And lately, at the bar of Bayonne, vast labour was necessary to destroy some ends of dikes, which were made anciently with pieces of waste stones; they were found as indestructible as if they had been united by the best cement."

We may see from this passage that the shells, which are found abundantly in some calcareous stones, might have contributed to their hardness by the addition of a gluten, similar to that which produces the hardness and solidity of corals; but as we do not find small shells so abundantly in all the calcareous banks, we are obliged to attribute the formation of those which do not contain them to another cause.

From all this it results, that it is not probable that we owe to the action of the carbonic acid on lime the formation of the banks of chalk, and of calcareous stones, the masses of which have evidently been accumulated and solidified in the water, but much rather to the action of the adhesion, combined, of the water on the particles of carbonate of lime, and of the particles of carbonate of lime on each other.

(*To be continued.*)

Report of the Select Committee of the House of Commons, appointed to inquire into the state of the law and its consequences respecting the Exportation of Tools and Machinery. (Continued from p. 269.)

With respect to the second objection, the apprehension of being undersold in the foreign market, the evidence of those witnesses in whom this apprehension is most prevalent, contains much which seems to incline in a contrary direction to the inferences drawn by them. It is admitted by them that we possess many facilities which foreigners do not, and may not for ages possess. Our minerals are generally in immediate neighbourhood, whence, from the proximity of rail-roads, canals and rivers, they may be conveyed with great facility to all parts of the kingdom, either for home manufacture or exportation. Almost all our great manufacturing towns, and establishments for the construction of machines, enjoy similar facilities; and thus, with the continual improvement of machinery, enable us to keep down the cost of production.

Upon this subject your Committee beg to refer to the following extracts from the evidence of Mr. M'Culloch, which, in their opinion, deserves the most serious consideration.

" Do you conceive that the laws rather assist the French " than otherwise, in being able to establish manufactories " of machinery of their own?—I should think our pre- " venting the exportation of machinery to France has a " tendency to force the French to become machine-makers " themselves, and to rival us in a branch of industry, into " which, if they could get machines from England, they " would have no motive to come into competition.

" Those laws make it more a matter of necessity on the " part of the French to induce our machine-makers to go " to France, to instruct them in the art of making ma- " chines?—Unquestionably.

" Do you conceive that if the French were to acquire " equally good machinery with ourselves, that it would be

" injurious to our manufactures?—No, I do not think it " would.

" By their obtaining our machinery, so as to be able to " meet us in the market for cotton and other goods, will " not that be injurious to us?—I do not think the circumstance of getting our machinery would enable them to " meet us in the market with cottons, or any other goods, " with advantage.

" Will you state what it is that would give England the " advantage in that case over the foreign manufacturers? " In the first place, the French manufacturer would not " have the same degree of security that the English manufacturer has; in the next place, you have the advantage of better communications throughout the country, " the advantage of trained workmen, habituated to all " industrious employments, and of a better division of " labour; so that, though the French imported from us " as good machinery as we have, you would still have " many incommunicable advantages which they could not " have, and you would always have cheaper machinery in " proportion to the cost of the transfer of the machines " into France.

" Will you have the goodness to state to the Committee " the advantages that would accrue to England from the " exportation of its machinery?—The advantages would " be, that in addition to all our present manufactures we " should have an additional branch of manufacture, corresponding in extent to the extent that the foreigner " took machines from us. You would thus have a new " field created for the profitable employ of capital and " industry, which you have not now."

Your Committee think proper to notice, as a third objection entertained by many of the witnesses, viz. that, in consequence of the low rate of wages paid on the continent of Europe, manufacturers in foreign countries would be enabled to sell their goods cheaper than we could sell ours.

Your Committee are sensible of the propriety of paying due attention to this objection; as not only many of the witnesses whom they have examined form their opinion of the impolicy of allowing machinery to be exported, on the grounds that the low wages of France and other nations secure to those countries advantages over England; but almost all persons of all descriptions consider this doctrine of the advantage of low wages as forming a settled axiom in political economy, and therefore as one which admits of no question whatsoever; but so far from this being a doctrine that ought to be universally received as sound and settled, your Committee are of opinion that many facts exist to show that doubts may be justly entertained respecting its validity. Experience proves, that in those countries where wages are low the workmen are often indolent, and so unskilful as to be incapable of producing any commodities but such as are of the rudest and coarsest kind; one workman is employed in two or more different operations in the same fabric, and little or no assistance is given to manual labour by inventions to abridge and economize it; whereas in those countries where wages are high the workmen are generally active, spirited, persevering, and exceedingly skilful; no article is too delicate or difficult for them to make; the principle of division of labour is in full operation, and every description of machinery is made to contribute extensively to the diminution of manual labour.

It is well known to those who have attended to what has taken place in respect to the cotton manufacture in Ireland, (and it has been alluded to in the evidence,) that when Mr. Pitt in 1788, and at the Union, proposed to lower the duties on cotton goods imported from Ireland into England, the witnesses who were then examined before Committees of this House, resisted his plans on the same grounds that the witnesses whom your Committee have examined object to the exportation of machinery, namely, the advantages which a country with low wages has over a country in which wages are high. But although

Mr. Pitt, at the Union, lowered the duties on cotton goods imported from Ireland into England to ten per cent.; and that cotton goods could be sent from Ireland to foreign countries to be sold there in free competition with English cotton goods; and although Ireland has imported from time to time the best English machinery, and employed the best English workmen to instruct the Irish workmen, yet Ireland, under all these circumstances, (with an average rate of wages of 3*d.* or 4*d.* a day, as proved in evidence before the Committee on the state of Ireland,) was not able to do any thing worthy of notice in the cotton manufacture till the repeal of the duty of ten per cent. in 1823 led to the sending of English yarn into Ireland to be wove there, and returned to England, and till English capital was employed in Ireland to promote the industry of her people, by giving orders for goods to be sent to England to enable the English manufacturers to make good those orders which they could not execute in England.

The case of England herself is also in point, to show that low wages may be counterbalanced by other circumstances; for though wages in England are much higher than wages in other countries in Europe, yet almost every kind of manufactured goods that are required in great quantities can be made so much cheaper and better in England as to find a market in almost every foreign country.

But besides these facts, tending to disprove the doctrine that low wages always give to a country advantages in carrying on manufactures, there exist the reasonings and conclusions of those learned and observing persons (who during the last fifty years have reduced the rules that govern the operations of industry and trade to a science), to explain in what way they consider this doctrine to be wholly untenable. These eminent persons undertake to show, by arguments and facts, that the effect of low wages is not a low price of the commodity to which they are applied, but the raising of the average rate of profits in the country in which they exist. The explanation of this proposition occupies a large portion of the justly-celebrated work of the late Mr. Ricardo, on the Principles of Political Economy; and is also ably set forth in the following evidence of Mr. M'Culloch, to which your Committee particularly desire to draw the attention of the House:

"Have you turned your attention to the effect of fluc- " tuations in the rate of wages on the price of commodities? " I have.

"Do you consider that when wages rise the price of " commodities will proportionally increase?—I do not " think that a real rise of wages has any effect whatever, " or but a very imperceptible one, on the price of com- " modities.

"Then supposing wages to be really lower in France " than in this country, do you think that that circumstance " would give the French any advantage over us in the " foreign market?—No, I do not; I do not think it would " give them any advantage whatever. I think it would " occasion a different distribution of the produce of in- " dustry in France from what would obtain in England, " but that would be all. In France, the labourers would " get a less proportion of the produce of industry, and the " capitalists a larger proportion.

"Could not the French manufacturer, if he gets his " labour for less than the English manufacturer, afford to " sell his goods for less?—As the value of goods is made " up wholly of labour and profit, the whole and only effect " of a French manufacturer getting his labour for less than " an English manufacturer is to enable him to make more " profit than the English manufacturer can make, but not " to lower the price of his goods. The low rate of wages " in France goes to establish a high rate of profits in all " branches of industry in France.

"What conclusion do you come to in making a com- " parison between wages in England and wages in France? " I come to this conclusion, that if it be true that wages " are really higher in England than in France, the only

" effect of that would be to lower the profits of capital in " England below their level in France, but that will have " no effect whatever on the price of the commodities pro" duced in either country.

" When you say that wages do not affect prices, what ' is it that does affect prices ?—An increase or diminution " of the quantity of labour necessary to the production of " the commodity.

" Supposing that there was a free export of machinery, " so that France could get that machinery, do you think " that under those circumstances we should retain those " advantages which we possess at the present moment ?— " Yes, we should ; for the export of the machinery would " not lower our wages, or increase the wages in France, " so that we should preserve that advantage to the full " extent that we have it at this moment.

" Will you explain to the Committee why you are of " opinion that the French manufacturer would not under" sell the English, seeing that his profits are larger than " the English manufacturer ?—Because if he were to offer " to undersell the English he can only do it by consenting " to accept a less rate of profit on his capital than the " other French capitalists are making on theirs, and I " cannot suppose a man of common sense would act upon " such a principle.

" Are the Committee to understand, that although a " French manufacturer pays half the wages to his men in " France, which our manufacturers do in England, yet " that his wages being on a par, or a level, in general, " with the other wages in France, will render his profits " on a par with them, and consequently he would not " undersell the English merchant by lowering his profits " below the average rate of profits in France ?—Precisely " so. I believe, in point of fact, there is no such dif" ference ; but he could not undersell the English manu" facturer unless he took lower profits than all other pro" ducers in France were making. I might illustrate this

" by what takes place every day in England, where you " never find the proprietor of rich land, in order to get rid " of his produce, offering it in Mark-lane at a lower rate " than that which is got by a farmer or proprietor of the " very worst land in the kingdom.

" Would it not produce a larger sale if the French manufacturer were to sell at a lower price ?—Supposing that " to be so, the greater the sale the greater would be the " loss of profit."

It is the opinion of many of those who object to the exportation of machinery, that Great Britain owes her present superiority in manufactures solely to the excellence of her machinery; but the evidence already noticed, as well as that of Mr. Martineau and others, would incline your Committee to believe that many other circumstances had tended to produce that effect, and that if the exportation of machinery was generally permitted, English engineers would supply the greater part of the world, without endangering her present superiority. " My reasons," Mr. Martineau says, " for forming this opinion principally " consist in the natural advantages that England possesses, " from the circumstance of the iron stone and coal being " invariably found in the same spot, and thus affording a " means of manufacturing iron at a cheap rate; the talent " and ingenuity of the workmen; the immense spare capital " we have in this country; the circumstance of our canals " and railroads already established, enabling us to bring " the raw material from the interior of the country at a " very low rate; it would of course take a considerable " time before France, or any other country, could possess " any of those advantages, even those which cannot be " considered as peculiar only to us, such as canals and " railroads."

To be concluded in our next Number.

Process for the Rectification of Alcohol without heat.

From the Annales de Chemie, May 1825. By M. E. PAJOT DECHARME.

HITHERTO alcohol, or more properly brandy, could not be rectified, or raised from an inferior to a higher degree, and consequently be brought to a superior state of purity and strength, except by distillation, an operation which could only be effected by an alembic and some heat.

The mode of rectification here treated of can be performed in the cold, and consequently without the aid of an alembic or of combustibles. The following in general is the method of proceeding:

On the one part there is poured into a vessel with a flat bottom a given quantity of the alcohol, which is desired to be rectified, whether it be small spirits (*petites eaux*), proof spirits of Holland, or spirits of a higher degree.

On the other part one of the most deliquescent salts is to be dried, either muriate of lime, or muriate of manganese; the first is preferable in point of economy, and the superiority of the second gives it a claim to be chosen; but it is less common, and not so easily obtained.

In another vessel with a large surface, and placed on three or more feet in the vessel which contains the spirits, is to be put the muriate of lime dried and pounded.

This disposition being made, the vessel which holds the alcohol is to be closed up completely, or its edges are to be secured with bands of paper pasted over them, and the whole is to be left in this state for four or five days. After this time the vessel holding the spirits is opened, and that containing the muriate is taken out. This salt is then found to be more or less dissolved, according to the quantity of water which it has attracted. The degree of strength of the spirits is then examined, and it is found to be increased 5, 6, or 8 degrees, according to the fineness of the grain of the dry muriate; it ought not however to be too fine, to prevent its becoming pastey, and to make its surface more extensive; the vessel holding the muriate is then cleaned, a new portion of the dry muriate is spread on it, and it is put back into its place, and then the vessel containing the spirits is again shut up in the same manner as before the insertion of this second dose of deliquescent salt.

By operating successively in this manner, highly rectified alcohol is obtained, and weak spirits of 10 or 15 degrees (of Baume's areometer) are raised to 40 or 42 degrees.

It may be conceived that this method may be applied to the concentration of various saline fluids, acids, &c. and that by a particular disposition of the factory, basins, &c. it would be easy to establish a rotation (of the processes), which, in a given time, would afford at pleasure daily products of all degrees of concentration.

M. Decharme is at present employed in trying to give to this process, by the aid of mechanism and natural philosophy, all the regularity, precision, and perfection, desirable, for a work on a large scale.

Preparation of a colour named Vienna Green. By Dr. Liebig. From the Bulletin de la Société d'Encouragement, Vol. xxii. (1823.)

Dissolve with heat, in a copper boiler, one part of verdigris in a sufficient quantity of pure vinegar, and add an aqueous solution of one part of white arsenic. During the mixture of these liquids, there commonly forms a dirty green precipitate, which it is necessary, for the beauty of the colour, to make disappear. For this purpose, a fresh quantity of vinegar is added, till the precipitate shall be re-dissolved. The mixture is then boiled, and after some time a granulary crystalline precipitate is formed, of a most beautiful green colour, which being separated from the liquid, well washed and dried, is nothing else but the green colour in question.

If the liquor still contains an excess of copper, more arsenic is to be added; and if it contains an excess of arsenic, it is necessary to add more copper, operating in other respects in the same manner. It often happens that the liquor contains an excess of acetic acid; in this case it may be employed anew, for dissolving verdigris.

This colour, thus prepared, has a blueish cast; but in commerce a deeper and yellower shade is required, retaining the same brightness and beauty. To produce this change, it will be sufficient to dissolve a pound of the potash of commerce in a sufficient quantity of water, adding to it ten pounds of the colour obtained by the above process, and heating the whole by a moderate fire. The mass soon deepens in tint, and takes the shade required. If it be boiled too long, the colour will incline to Scheele's green, but will always surpass it in beauty and brilliancy. The alkaline liquor, remaining after this treatment, may still serve for preparing Scheele's green.*

A useful glazing for common earthenware. By M. ROSCHINSKI. From the Bulletin de la Société d'Encouragement, Vol. xxii. (1823.)

M. Rochinski, a manufacturer of earthenware at Berlin, has found a varnish or glazing for common pottery, which, after trials made in the presence of the college of medicine, offers no danger in regard to health, and resists the action of the acids. This glazing is composed of five parts of litharge, two parts of well purified clay, and one part of sulphur. These substances are pulverized, and mixed with a sufficient quantity of caustic alkaline lie, (soapmakers' liquor) so as to form a mixture fit to be readily applied on the earthenware, and to cover it equally all over. Carefully baked, these wares offer no trace of lead.

The reader will find a short account of the new kinds of glaze, called *lustre*, made with precipitates of gold and platina, in Dr. Brewster's Encyclopedia, Vol. xvii. p. 137. in the article Pottery; an article much too brief, when we consider the importance of the subject, and the space devoted to matters of less moment: for instance, Pyrotechny occupies no less than 64 pages of the volume referred to, while Pottery occupies but two pages and a half! M.

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* Scheele's green is a combination of deutoxide of arsenic and deutoxide of copper.

NOTICES OF NEW PATENTS.

Patent granted to THOMAS CARTMELL, *of Doncaster, gun-maker, for an improved cock, to be applied to the locks of any gun, pistol, fire-arms, or ordnance, for the purpose of firing the same by percussion, acting either by self-priming or otherwise, and whereby the priming is rendered wholly impervious alike to the rain, wind, or damp.* Dated November 6, 1824.

THREE methods are described by the patentee for effecting the purposes recited in the above title. The first is for the application of single percussion balls, each time that the piece is primed; the other two are for self-priming from small magazines of these balls.

The machinery of the locks is the same as for common percussion locks, the improvements of the patentee being confined to a little apparatus placed on the top of the cock, which, except immediately beneath this part, is not different from a percussion cock of the usual form.

In the first method, a small cavity is made in the front of the cock, sufficient to hold a single percussion ball, which cavity is placed so as to fall upon a point projecting from the lock, called here the "striking peg," through which the touch-hole is drilled into the cavity of the piece; one of the small percussion balls is put into this same cavity, either by hand, or by a charger, each time that priming is required, where, if not prevented, it would be liable to fall out, and to be spoiled by wet; but, to preserve it from these accidents, the patentee has contrived a little cap that shuts over it from above, which is fastened to the hinder part of the cock by a hinge or joint, where a small knob projects from it, against which a thin spring presses that runs up the back of the cock, to which it is fastened at its lower extremity by a screw; the use of which spring is to keep the cap fixed in its place, either when shut down, or when entirely raised. As the front of the cap lies exactly before the percussion ball when shut down, in order to raise it out of the way of the percussion, when the cock is let go, a sloping "cheek" projects from its inner side, which, in the descent of the cock, strikes against a piece that projects for that purpose from the side of the lock, that by the action of the inclined plane of the cheek produces the desired effect; the cock then passes on, holding the percussion ball entirely uncovered, drives it against the striking peg, and ignites it by the percussion.

The second method, in addition to the cap above described, has a small magazine, like a flat thimble, that fastens on the top of its fore part by a dove-tailed slide, with a hole in its lower part near the front, through which a single percussion ball only can fall at once into a small receptacle prepared for it in front of the cock. To prevent the rest of the balls from falling out when the cap is raised, a thin flat spring, that lies on the top of the cock, passes below the hole through which the balls fall when in that position, and closes it until the cap is put down; which motion removes the hole from over it, and again leaves the passage open. These different relative positions of the spring stopper, and of the front of the cap, are effected by merely having the joint of the cap at the back of the cock placed about half an inch lower down than the fast end of the spring, by which means the cap, in being raised by its sloped cheek, is also pressed back along the front of the spring stopper; and again in being shut down passes forward over it, so that the hole in its front goes entirely beyond it, and leaves the passage for the percussion balls unobstructed.

In the third method there is no moveable cap, but the magazine for the percussion balls is fixed directly on the front of the top of the cock, and close beneath it a small square bolt passes through the head of the cock from the back to the front; near the front of this bolt is a hole, through which the balls pass, one at a time, to a small receptacle beneath in the front of the cock, by which it is conveyed to the "striking peg," as in the other methods, when the cock is let go; at which time the bolt is pressed back, by a part that projects from the lock for that purpose; so that the solid part of it comes beneath the opening of the magazine, and prevents all communication between it and the receptacle; the bolt is again restored to its first position, when the cock is raised by a spring that lies flat against the back of the cock; whose upper part acts on the bolt, and lower part is fastened to the cock by a screw.

To keep the small percussion ball in the receptacle, another spring is placed at the side of the head of the cock, directly below the bolt, having a triangular head, which closes up the front of the receptacle when the cock is raised; but, as soon as it is let go, the side of the triangular head farthest from the spring comes in contact with the side of the striking peg, which, by the action of the inclined plane, moves it to one side, from before the percussion ball, and leaves the latter exposed to the top of the striking peg, against which it is forced immediately after, and ignites the charge.

These contrivances are all very ingenious; but the first of them, of which the inventor thinks least, seems preferable for its simplicity, and for being least liable to accidents of explosion, to which we think all magazines for percussion powder subject, though we confess that those above described are as little so as any we have seen.

It appears to us also that the magazines have no certainty of delivering the balls as the patentee states; but that on the contrary they would be very apt to obstruct one another in their descent, so as not to be made to come down without taking off the magazine to free them, to which accident they would be peculiarly liable in damp weather, which would more or less affect the chlorite of potash, or other explosive salt in their composition, so as to make them somewhat adhesive at their surfaces; for though the cap defends the percussion balls well against rain, it could not protect them from atmospherical moisture, which must penetrate wherever the air has any access.

Patent granted to ALEXANDER DALLAS, *of Holborn, Engineer, for a machine to dress or pick stones of various descriptions, particularly granite stone.* Dated April 27, 1824.

THIS instrument is the same in principle as some tilting hammers used in forging; and consists of a rafter, or beam, suspended on a pivot between two uprights, which pivot is nearer one end, so as to divide it into a long and a short arm. At the end of the short arm a vertical wheel is placed, from 9 to 15 feet in diameter, in the plane of the rafter, from whose edge three catches project, at equal distances from each other, which, as the wheel is turned round, in succession depress the short arm, and thereby elevate the long arm, to whose extremity a block of wood is fastened that holds the chisel, or other cutting tool, which is to pick or dress the stone which is placed beneath it; and which block falling down as the catch passes from the short arm, by its weight and accelerated velocity strikes the tool against the stone in any place directed by the workman; it being so placed beneath the tool in a truck that stands on a small platform, which turns horizontally on a vertical pivot,, that by moving the truck by its handle, he can easily bring it into any position required, and of course cause the tool to strike it wherever he pleases.

The height to which the tool is raised above the stone by this wheel is from one to three feet; and to guide it more exactly in its fall, two other uprights are placed near the end of the short arm, between which it moves up and down. The wheel may be turned by human labour, by horses, wind, water, or steam, as preferred, in any of the usual methods of applying these powers.

The present high price of cut stone, and the great advantage to be derived from a more extensive use of it (particularly in preventing fires, when applied in staircases), renders every contrivance of importance which may tend to reduce its cost, by diminishing the human labour necessary in cutting it to the form required.

The machine above-described might be improved by the addition of a wooden spring above the longer arm, similar to those which are used for tilting hammers; and also by having the catches placed nearer the centre of the wheel, instead of their being on its circumference, by which the wheel would have more power as a fly wheel in regulating the equality of the power and of the blows.

Where a number of holes would be required to be cut in a line, for wedges to split the stone, a set of upright spars, made to move up and down vertically, in a similar manner to the drivers of an oil mill, would make quicker work by cutters fastened to them, than this patent machine; particularly if the cutters were made to move a little round their own centres, so as not to fall precisely in the same spot at each descent.

Patent granted to MR. SAMUEL CROSLEY, *of Cottage-lane, City-road, for certain apparatus for measuring and registering the quantity of liquids passing from one place to another.* Dated 1st Feb. 1825.

THE patentee states his object to be, in this apparatus, to produce a method of measuring the quantity of liquor, that passes from one vessel to another placed at a lower elevation, where consequently the liquor will sustain a greater pressure; this apparatus he calls a "liquid-meter," and describes two different forms for its construction, the latter of which is more proper for measuring liquors of a thicker consistence.

The first form of the instrument described resembles the gas-meter, used sometimes for registering the quantity of gas delivered from the reservoir of coal gas works, and consists of two concentric hollow cylinders, divided into compartments in the intervening space by partitions in the direction of the radii. There are two apertures in each of these compartments at the angles diagonally opposite; one of which forms a communication between the inner cylinder and the outer one, and the other affords a passage from the latter to an external air-tight vessel that encloses the whole, leaving sufficient space between them for the liquid-meter to turn freely round inside. A tube passes through the external case into the centre of the inner cylinder, of which it forms the support at the side it enters, and round which it revolves, the liquor being prevented from passing out between the tube and the end of the cylinder by a collar stuffed so as to prevent its transmission; a short fixed pivot passes at the opposite side from the external case to the centre of the other end of the cylinder, which has a thimble, or receptacle fixed to it there for its reception, which pivot forms the opposite support for the cylinder in its revolutions, the other being the tube, as already mentioned. Through this tube the liquor passes from the higher vessel into the inner cylinder, and from thence into the bottom of one compartment of these between it and the outer cylinder, in which as it rises it makes the cylinder revolve in proportion as its weight in that compartment exceeds the weight at the opposite side of the cylinder. The liquor proceeds in this manner in depressing that side of the cylinder, until the outer aperture from it into the case comes on a level with the top of a tube, that passes from one side of the case into the lower receiving vessel, at which time it begins to pass from the entering tube into the second compartment, and so on through all the compartments, as they successively are impelled round; the height of the top of the delivering pipe, where it enters the case, regulating the height at which the liquor will remain in the lowest compartment. It is to be noted here, that the patentee takes for granted that the air enclosed originally in the cylinder, and in the case, will remain in them unaltered, except in being reduced in bulk by the pressure of the liquor of the upper vessel, from which the liquor is transmitted; being aware that if there was no air enclosed, the liquor would pass without causing the cylinder to revolve.

The other form for the liquid-meter resembles an instrument, used for shifting the valves in some hydraulic engines, and consists of a trough open at both ends, with a partition across its middle; directly underneath which it is supported by two pivots, one at each side; and exactly over the line of these pivots, the pipe that comes from the upper vessel passes out over the middle of the partition, by which arrangement, as soon as the angular compartment, formed by the partition and one half of the trough, receives a certain measure of liquor, it outweighs the other half, falls down, until it is stopped by a bar placed to regulate the degree of its descent, and thereby shifts the position of the partition, so as to cause it to incline in the opposite direction, and bring its other side and the empty half of the trough, beneath the pipe from which the liquor is running. This other half of the trough in like manner falls down as soon as full, and causes the first half, which has been emptied in the mean time, to come beneath the pipe to be filled in its turn, and thus the two sides are made to act alternately as long as the liquor is delivered.

This apparatus is enclosed in an air-tight case, similar to that first mentioned, from the lower part of which a tube passes in like manner to the lower vessel.

Besides these parts described, wherein the two sorts of the apparatus are differently constructed, they have also machinery attached to them, or a species of clock work for giving motion to an index, which, by the arrangement of multiplying wheels well known, like those used in other registering instruments, points out the number of measures in the one case of the compartment, and in the other of the half-troughs which have been transmitted of the liquor through the apparatus.

In stopping either of the transmitting tubes by a cock, the liquid-meters cease to act, and again commence their operations on its being opened.

We are always really sorry when we are under the necessity of pointing out defects in the plans of ingenious patentees, which proper experiments, previous to the enrolment of their specifications, might have led them to avoid or remedy. The patentee will find on trial that the air enclosed in his liquid-meters, which he knows is essential to their operation, will be absorbed by the liquor in passing, and this in a greater proportion and more rapidly, as the pressure from the height of the upper vessel is greater. The liquid-meter will therefore, from this cause, after working some time, cease to give any motion to the index, and will let the liquor pass through without affording any indication of its transmission, and will continue in this state until again replenished with air.

Patent granted to William Harrington, *of Crosshaven, County of Cork, Esq. for an improved raft for transporting timber.* Dated June 15, 1824.

To form Mr. Harrington's raft, the keel, stem, and stern posts of a ship are to be put together in the usual manner, and on the keel floor timbers are to be laid across, and futtocks and frame timbets added to them, so as to form the frame (or skeleton) of a vessel; but, according to the draft, having the timbers farther apart than for a ship. These various parts are to be well bolted together, and then wale-pieces are to be fastened over the timbers from stem to stern, across which at proper intervals beams or long planks are to be laid, and secured to them by dove-tailed joints and other fastenings; the frame, according to the draft, will in this state be open at both ends, into which the balk or timber to be conveyed is to be introduced, and arranged fore and aft close together, so that at the stem and stern its ends may lie in the form suitable for those parts. In building up the balks proper intervals should be left for the masts, ends of the cable bits, and windlass bits, and other pieces that descend vertically into a vessel; or those pieces may be put up in their proper places in the first instance, and the timber be built up about them. When the timber is thus packed up close to the beams or cross-ties, pieces should be laid across between these ties of the same thickness with them, so as to leave no interval unfilled in any part. Then another course of wale-pieces is to be fastened on the frames, at a due height above the former course, beams or tie-pieces to be laid across and dovetailed into them as before, and the balk to be then built up close to them from below in the manner already described. When this part is completed, a third course or streak of wale-pieces is to be fastened on above, at the level of the upper deck, and to be secured with beams and tie-pieces like the others; but in this upper part the balk is only to be built up at the forecastle and stern, and an interval left in the middle, in which is to be formed a place for lodging the sailors who are to navigate the raft, and for stowing the provisions and the tackle, for the construction of which place no adequate directions are given, farther than to state that planks are to be fastened outside in this part, and a deck to be formed above; but this can hardly be said to be peculiar to this part, as the whole of the upper part is elsewhere directed to be decked, as well as to be furnished with such posts, rails, and other parts, as are necessary for navigating a vessel, and are usual; and moreover the whole outside is directed to be planked over when the balk is built up inside.

When rough weather is expected, staples, cleats, and other fastenings, are advised to be used in building up the balks, to prevent their shifting their places over one another in the pitching of the raft; and it is also stated, that the whole may be farther secured by fastening hoops of iron, or of other materials, round the outside.

This invention does not appear to us a very economical mode of forming a raft. In fact the patentee, without appearing to be aware of it, has in reality directed a ship to be formed outside his raft in building it up, having keel, stem and stern posts, floor timbers, foothooks, top timbers, planks, decks, &c. the same as another vessel; and when it is considered that this imperfect vessel must be broken up at the end of the voyage, it would most probably be found that the loss would more than counterbalance any saving, which might arise from the rough construction and unfinished state of its several parts.

It may frequently be desirable to effect the transport of large quantities of timber in one conveyance across the ocean, but for this purpose no part of the plan of the patentee appears adviseable to be adopted. Perhaps if a raft were formed in the shape of a punt, but much broader in proportion, with the layers of timber alternately crossing each other, and fastened together by bolt iron running between the pieces of timber, both vertically and across from side to side at certain intervals, and well secured by keys, or screws and nuts, to the outside pieces, so as to brace the whole firmly together, it might be navigated safely; while the whole of the iron work might be sent back after the voyage in a common vessel, to serve again for constructing another raft, without causing any loss but what the bolt holes in some of the outside pieces would occasion, in somewhat diminishing their value for some purposes, though for others they would be in no way injurious to them. This rough plan we could easily show to be feasible, but our limits will not at present allow us to enter into the detail.

The mode for lodging the crew, and finding stowage for necessaries for the voyage, proposed by the patentee, as we have before stated, appears deficient; but probably if a small sloop, or other vessel, were built up in the centre of the raft, it would answer this purpose much better, and serve afterwards to take back the sailors at least to the port from whence they sailed, if not large enough to carry along with them the iron work of the raft abovementioned, when used with one of this construction.

Patent granted to JOHN HEATHCOAT, *of Tiverton, Devonshire, Lace-manufacturer, for an improved mode of producing figures or ornaments in or upon a certain description or kind of goods, manufactured from silk, cotton, flax, or other thread or yarn.* Dated February 26, 1825.

THE object of this patent is the use and application of purl in making figures and ornaments on lace.

In the first of three methods for the above purpose, which are described in the specification, it is directed that designs of figures or ornaments, such as sprigs, bouquets, &c. be traced on the lace, previously stretched in a frame, after which the purl is to be taken, with which article it is asserted all lace-manufacturers are well acquainted, and one end of it is to be applied to one of the said figures or ornaments, and to be sewed or otherwise fastened to the lace, according to its outline and frame, and then successively to the other figures, in the same manner.

In the second method the figures are to be traced on a cushion, and the purl to be then pinned on it, according to their form; after which the lace is to be laid down on the cushion, and the figures so formed with the purl to be sewed on it, and then to be detached from the cushion.

In the third and last method, the figures or ornaments are to be traced upon paper, over which the purl is to be pinned, so as to represent their form, and then to be sewed to itself so as to preserve that form afterwards. The figures thus produced are then to be detached from the paper, and may be sold by themselves separately, to serve as a substitute for Brussels sprigs in ornamenting lace.

WE understand there is a considerable demand for Brussels sprigs. If, therefore, the article last mentioned in the specification can be made equal in beauty to the Brussels sprigs, or even sufficiently approaching to them in appearance so as to come at all in competition with them, it is evident that this circumstance will make the patent proportionably valuable.

FRENCH PATENTS..

An Account of Inventions for which Patents, or **Brevet d'Inventions,** *have been obtained in France, and which are now expired.*

Brevet d'Invention for five years, granted to **M. Brice Maizierre,** *mechanist, Rouen, for a method of saving many horses employed in mills, by applying to the axle of the lantern wheel, which is put in motion by the horse wheel, a fly with four arms, each carrying a heavy weight.*

This brevet requires no explanation farther than what is given in the title; we have, however, to observe, that the contrivance is of ancient date, as a fly of the same sort, for the same purpose, and having four arms also, is described in the 2d Vol. of Desaguilier's Experimental Philosophy, published in 1763, as being used in Vauloüe's horse engine for driving piles.

Brevet d'Invention for fifteen years, granted to **M. J B. Mollerat,** *for a process for extracting soda from sulphate of soda.* Dated June 27, 1806.

Dissolve lime or calcareous matter in pyrolignous acid, either cold or hot; the liquor will then become covered with a vegetable oil, which this material contains, and which may be separated from it by mechanical means; dissolve, then, in the liquor thus saturated with lime, a quantity of sulphate of soda, to be determined by the degree which the calcareous solution will indicate by the areometer for salts.

By this process the sulphuric acid quits the soda, and forms with the lime a solid salt, which precipitates to the bottom of the vessel that contains them.

The liquor which lies above the sulphate of soda, evaporated and crystallized, will yield acetite of soda, if it is wished to collect that salt; or if it is dried and burned, either on the floor of a reverberating furnace, or on the grate in the front of a furnace prepared for that purpose, it will give carbonate of soda, of which a hot lee will form crystals of the greatest purity by refrigeration.

Brevet d'Invention for ten years, granted to M. Burette, *Paris, for making bricks (or square lumps) of fossil coal, of charcoal of wood, and of charcoal of turf, without the use of a cement of clay.* Dated June 12, 1811.

The method of performing this consists in mixing the combustibles mentioned, reduced to a state of powder, with a glutinous substance, whether animal or vegetable, the price of which is as low as possible. M. Burette states that he makes use of residues of common glue, of glutinous pastes made of flour, and of those produced by lichens and mosses, and generally of all other substances, except the earths, which have sufficient tenacity to re-unite the said coal or charcoal, in a solid form.

The proportion of the glutinous matter which is to be employed, cannot be precisely determined, on account of its greater or less tenacity; but a certain rule for ascertaining this is to make the mixture so that the coal or charcoal powder may have sufficient consistence, when it is converted into the bricks (or lumps). A simple trial with a small quantity of the materials, will soon show the proper proportions of the mixture.

With regard to the form of the bricks, that in common use (for building bricks) should be used.

Brevet d'Invention for five years, granted to MM. Amavet, *and* Belleville, *of Paris, for a wheel with moveable flash boards.* Dated April 23, 1816.

This wheel, made of wood, is composed of an arbor or axle of an octagonal shape, having eight frames projecting from it, on which are fastened by hinges the moveable flash boards, independent of each other.

This arrangement causes the flash boards, or impellers, which are about to pass out of the water, to be always in a vertical position, which prevents them from carrying up any weight of water with them, and from counteracting in any manner the effect of the other flash boards, which present their surfaces to the action of the current.

Brevet d'Invention for five years, granted to M. CHARLES, *cutler, at Paris, for making razors with* metallic backs, *and with blades which may be changed.* Dated February 27, 1817.

THE backs of these razors are made full in all their proportions, and yield to the file; they are grooved the whole length of the blade, by a cutting wheel put on a lathe, and are polished by a buff wheel, mounted also on a lathe; the upper extremity of each is pierced with a hole, which receives a screw to which the blade is hooked.

The blade, which is of cast steel, is forged flat, and filed on a mould, which corresponds exactly with the groove in the back; it is then tempered, and afterwards whetted to finish it.

This blade has at its back, near its upper extremity, a small oblique cavity, which forms a hook, by which it is hooked to the small screw of the back. The lower extremity of the blade forms a re-entering angle, which rides over the prolongation of the back at the place where the groove terminates.

When the blade is thus fitted in the groove of the back, the screw is turned till it draws together the two sides of the back sufficiently to prevent the blade from moving in any direction.

To take off the blade, it is only necessary to turn back the screw that keeps it in its place.

Brevet d'Invention for five years, granted to M. CHENEAUX, *of Paris, for a new strap for whetting razors.* Dated July 12, 1816.

MANNER OF PREPARING THE STRAP.

TAKE a piece of common leather, leave it to soak in warm water, and then rub it over with a matter composed of the filings of cast steel dissolved in aquafortis, made red hot in a crucible, and pounded to reduce it to powder.

This meagre composition, of a red colour, without any sort of mixture with oil or grease, will make the strap different from all those hitherto manufactured, and cause it to produce an edge preferable to that given by the hone or the polisher.

The Operative Mechanic, and British Mechanist, *being a practical display of the Manufactories and Mechanical Arts of the United Kingdom.* By John Nicholson, Esq. *Civil Engineer.* 8vo. pp. 796. Knight and Lacey, 1825.

This work, as stated by its author in the preface, is designed as a companion to the workshop. Its contents, besides some elementary matter on the mechanical power, &c. with which it commences, consist of explanations and accounts of mill-geering, water-mills, wind-mills, steam-engines, hydraulic engines, accessory machines, manufacture of metals, manufactures of fibrous materials, various mills used in manufactures, &c.; pottery, horology, building (divided into eleven heads), rail-roads, and locomotive engines; with an appendix, containing practical geometry, mensuration, useful receipts, and a glossary.

This compilation is in most respects well executed, the descriptions plain and intelligible, and the selections for the most part interesting and useful, and such as do credit to the industry and attention of the author; and on the whole it is a very respectable performance, which would serve well as a book of reference to masters and employers, and to gentlemen out of trade, who must occasionally direct workmen on their estates, and to those who on any other account are desirous of the variety of useful information which it contains, as well as to those for whom it was intended; though to those latter not so much as the author may imagine.

After saying this much in its favour, the author will, we hope, excuse a few words of advice, which we shall offer chiefly with a view to the improvement of the next edition. It is obvious that where so many articles claim to be inserted, brevity must be studied; but if a few additional pages would make a book more complete, we think neither author nor proprietor would be inclined to omit them, if convinced of their utility.

The very interesting subject of bridges has been entirely omitted, to which, including some notice of those on the suspension principle lately erected, a page or two might have been advantageously devoted, with a few lines on the catenary curve; or at least the method of describing it should be added to those of the other curves most in use.

The very good collection of hydraulic engines would be made more complete by an account of Godwin's engine; of two or three from Ramelli and M. Serviere; and of Gwyn's patent engine; the figures of which are given in the 23d plate of Young's Nat. Phil. under the numbers 313, 314, 315, 316, and 317.

Several small inaccuracies in the plates require correction, though the general execution of them is very creditable to the engraver; they should be all carefully looked over, and compared again with the letters of reference, as in several instances these are not to be found in the figures, as in the case of Bonnard's wooden piston; several typographical errors also require correction. The index is not by any means full enough for the work, nor is the glossary as correct as could be desired.

Some few parts in the elementary portion we could wish to see more perfect; of which we shall instance the article on friction, on which subject, so important to mechanism, only twenty lines are given, and these by no means satisfactory.

In a few instances the author has evidently been led away by the forced and artificial celebrity, or rather publicity, of some new contrivances, which are not sanctioned sufficiently by experience, or satisfactory proof, to merit the eulogiums he has unwarily bestowed on them; of those, the most conspicuous is the machine commonly called Brown's vacuum engine, but in reality the invention of the Rev. Mr. Cecil, as explained in a paper respecting it in our Number for August last, in which is also pointed out the powers and defects of the contrivance, and its liability to cause explosion.

Next, after describing Palmer's single rail-way, the author states that "*this arrangement certainly seems to ensure the grand principle of lessening friction;*" an assertion originating with the inventor, and copied from one ephemeral publication into another without consideration, a proceeding which such a work as the present surely ought not to imitate; but, if we are mistaken, and the author really on mature reflection is still of this opinion, we should be glad to have his reasons as an engineer stated for this assertion, and some fair proof given in support of it; of which as yet we have not seen the slightest appearance in any of the many accounts which have appeared respecting this rail-way. Thirdly, the praises of Messrs. Taylor and Martineau's steam-engine, and the high opinion which the author evinces to have of it, by selecting a draft of it for his frontispiece, do not seem judicious. The engine, as to its execution and workmanship, may have its merit; but the author ought to have known the radical defect of all horizontal steam-engines sufficiently, not to commit himself by so public an approbation of them. This great defect, which consists in the inequality of the friction of the piston on the main cylinder, that must in a short time totally destroy the figure of the latter, has been attempted to be remedied in one of a similar species, now used at the tunnel at Rotherhithe, by connecting an arm to the cross-piece to which the piston rod is attached, which arm runs in the same direction of this rod, and parallel to it, and is supported by a roller at its farther extremity, that moves on a bar, fixed purposely to sustain it; this from being at the side of the piston instead of directly over it, as it ought to be, adds to the friction by the twist which it gives to the frame of which it forms a part, so as perhaps to do some mischief; but even if fixed in the best manner, unless in very small engines, where the weight of the piston must be trifling, we think it could hardly act sufficiently well to put engines of this sort on a par with those which have vertical cylinders, though certainly the idea of this improvement is judicious, and will prevent a great part of the injury caused by the inclination of the cylinders. It is true that the engine at the tunnel is not precisely an horizontal engine, as each of its cylinders is placed so as to form an angle of 45° with the horison; but, proportionally as the cylinder deviates from the perpendicular, it is obvious that it must more or less be liable to the injury stated, and so far be defective.

The corrections and improvements which we have suggested for a future edition, would require but a very few pages; but there are other articles which ought to be added to it, to render the work complete, that would perhaps increase its bulk a good deal. We allude to accounts of those manufactures and arts, of which no notice whatsoever has been taken in it, though apparently as deserving of it as some of those which have attained a liberal share of attention, of which we shall only mention the machinery used in the stocking business, and that in the lace manufacture; the latter of which is peculiarly curious and worthy of notice as a mechanical lesson, and both are manufactures of importance, in which great numbers of workmen are employed. We are aware that the limits to which a work of this kind must necessarily be restrained, may be urged as an excuse for their omission; but we think it obvious that where it is necessary a work should not exceed a certain number of pages, that the design of it should be equally limited, to prevent its being an arbitrary selection out of many subjects equally comprised in the design, but impossible to be brought within the bounds prescribed. Indeed, were works to be published of which the advantage to workmen was to be really the chief object, we are inclined to think they had much better consist of single treatises upon the matters most necessary for each separate trade, than of collections treating of a great many trades and manufactures, and where of course the greatest part must be of little moment to those of any single calling. Treatises of this kind, with a few on those elementary parts of science in which most trades are interested, would form the *best companions for the workshop*, as every workman would then purchase that part which best suited him, without being obliged to lay out his money for what did not concern him, in order to get at that which was immediately applicable to his own business.

But taking the book as it really is, without limiting it, as the author has done, to the use of a peculiar class, we think very well of it, and have now only to add, that from the many useful tables inserted in it, and the general information which it contains, we know of no more useful publication as a work of reference on the many subjects of which it treats, that can be purchased for more than three times its present price of thirty shillings.

LIST OF NEW PATENTS.

William Duesbury, of Boasal, Derbyshire, colour manufacturer, for a mode of preparing or manufacturing of a white, from the impure native sulphate of barytes.—Dated September 29, 1825.—Six months to enrol specification.

John Martineau, the younger, of the City Road, Middlesex, engineer, and Henry William Smith, of Lawrence Pountney Place, in the city of London, Esq. for improvements in the manufacture of steel. Communicated to them by a foreigner.—Dated October 6, 1825.—Six months to enrol specification.

Sir George Cayley, of Brompton, Yorkshire, Bart. for a new locomotive apparatus.—Dated October 6, 1825. Two months to enrol specification.

James Shudi Broadwood, of Great Pultney-street, Middlesex, pianoforte maker, for improvements in small, or what are commonly called square pianofortes.—Dated October 6, 1825.—Six months to enrol specification.

Thomas Howard, of New Broad-street, London, merchant, for a vapour engine.—Dated October 13, 1825.—Six months to enrol specification.

Nathaniel Kimball, of New York, merchant, for a process of converting iron into steel. Communicated to him by a foreigner.—Dated October 13, 1825.—Six months to enrol specification.

Benjamin Saunders, of Bromsgrove, Worcestershire, button manufacturer, for improvements in constructing or making of buttons.—Dated October 13, 1825.—Six months to enrol specification.

Thomas Dwyer, of Lower Ridge-street, Dublin, silk manufacturer, for improvements in the manufacture of buttons.—Dated October 13, 1825.—Six months to enrol specification.

Joseph Clisild Daniell, of Stoke, Wilts, clothier, for improvements in machinery applicable to the weaving of woollen cloth.—Dated October 13, 1825.—Six months to enrol specification.

Josiah Easton, of Braford, Somersetshire, Esq. for improvements in locomotive or steam carriages; and also in the manner of constructing the roads or ways for the same to travel over.—Dated October 13, 1825.—Six months to enrol specification.

William Hirst, John Wood, and John Rogerson, of Leeds, for improvements in machinery for raising and dressing of cloth.—Dated October 21, 1825.—Six months to enrol specification.

Ralph Stephen Pemberton, and John Morgan, of Lanelly, Carmarthenshire, for a consolidated or combined drawing and forcing pump.—Dated October 21, 1825.—Two months to enrol specification.

Goldsworthy Gurney, of Argyle-street, Middlesex, surgeon, for improvements in the apparatus for raising or generating steam.—Dated October 21, 1825.—Six months to enrol specification.

Lemuel Wellman Wright, of Princes-street, Lambeth, Surrey, engineer, for improvements in the construction of steam-engines.—Dated October 21, 1825.—Six months to enrol specification.

Henry Constantine Jennings, of Devonshire-street, Middlesex, practical chemist, for improvements in the process of refining sugar.—Dated October 22, 1825. Six months to enrol specification.

THE

REPERTORY

OF

PATENT INVENTIONS, &c.

No. VI. DECEMBER, 1825.

Specification of the Patent granted to WILLIAM GILMAN, *of Whitechapel Road, Middlesex, Engineer, and* JAMES WILLIAM SOWERBY, *of Birchin Lane, London, Merchant, for certain improvements in generating steam, and on engines to be worked by steam or other elastic fluids.* Dated April 13, 1825.

WITH A PLATE.

TO all to whom these presents shall come, &c. &c. *Now know ye,* that in compliance with the said proviso, we, the said William Gilman and James William Sowerby, do hereby declare that the nature of our said invention, and the manner in which our said improvements are to be performed and carried into effect, are set forth and explained in and by the sheet of drawings hereunto annexed, and by the following description thereof, (that is to say): Our improvement for generating or producing steam consists in placing one or more cylindrical boilers, B B, horizontally over the fire place, C, of our furnace, as seen in the sections, figs. 2 and 3, (Pl. XII.) within which boilers are shafts or axles, *d d d d,* running through their whole length, which shafts have leaves or paddles attached to them; and being connected together by the cross shaft and bevelled geering, shown in fig. 1, they form agitators.

These agitators are caused to revolve within the said boilers by the engine, or other adequate means, with sufficient velocity to give motion to the water injected into the said boilers, for the purpose of being converted into steam, by which means, and the assistance of its centrifugal force, the said water is spread in an extremely thin sheet over the whole internal surface of the metal whereof such boilers are made, and by the said leaves being fixed obliquely, or at an angle with the shafts or axles, the water is thereby carried or worked forward from the ends, at which it is injected to the other ends of the said boilers. Or this carrying or working forwards of the injected water may be effected by its own gravity (and without obliquity in the leaves) if the boilers are fixed in duly inclined positions, and the water be injected at their upper ends. The water may, with the use of horizontal boilers, be injected at either end, and the steam be taken out at the same or contrary end of either of the boilers, as convenience may suit. The agitators are either used simply as above described, or with concentric cylinders of thin copper or other suitable metal, fixed on their arms, as shown by the dotted lines in the sections, figs. 2 and 3, and they have the leaves or paddles attached to their circumference. The object of this arrangement is to prevent the water from being carried with the steam into the steam pipe, P, of the engine. And in order to prevent the agitation of the water in boilers used for generating steam on board of boats or vessels, or in carriages to be propelled thereby, from interrupting or rendering irregular the generating or supplying of steam to the engine, we sometimes provide a steam chamber, separated from the upper part of such boiler by a valve or valves, opening into such chamber. These aforesaid concentric cylinders, (or cones, if the fancy of the engineer should lead him to make the ends of different diameters) being mounted within the boilers, admit the steam through the numerous minute holes with which their whole surface is pierced, with the exception of a strip or line, about two inches wide, immediately adjoining and running parallel with the face of each leaf or paddle, which unpierced strip supports and assists in carrying the newly injected water whilst it is acquiring the necessary momentum, and is spread on the internal surfaces of the boilers, and is being heated. The steam, after passing through these minute holes into the insides of the revolving internal cylinders, flows through the steam connecting pipes, R, figs. 1 and 2, which pipes are curved so as to project within the boiler as far as the arms of the agitators will permit, whereby the steam flowing to the working cylinder of the engine (instead of sweeping the sides when the boilers are small, and carrying with it a portion of the water), is compelled, as fast as such steam is produced, to pass through the minute holes in the revolving cylinders at right angles, by which that effect is avoided. The tiers of tubing or pipes, No. 1, 2, 3, 4, sections, figs. 2 and 3, are traversed by the water destined to supply the boilers, length by length, in every tier successively, from No. 1 to No. 4; and the said water likewise passes through those other pipes that line the fire place on each side, previous to the entrance of such water (when considerably heated) into the chambers of the transfer pumps, I I, fig. 1. The forcing pumps, F F, fig. 1, inject the cold or new supply of water: G is the cold water reservoir: H the suction tube: N N the injection pipe connected at N, figs. 2 and 3, with the first tube or pipe in the upper tier. The transfer forcing pumps, I I, receive the heated water by the pipe, K, connected to the last tube or pipe, K, fig. 3, of the system of such pipes, lining the fire place, from the chambers of which pump the said water is forced through the pipe, L L L L L, figs. 1 and 2, into the boilers; and when there, is carried or worked forward by the agitators in the manner as before stated. The arrangement of these pumps is such, that on their being put in motion (by any of the usual methods), a certain quantity of cold water, proportionate to the bore and length of stroke, will be injected by one of the pumps, F, into the upper tier of tubeing, and during the same time an equal supply of the heated water will be obtained in the chamber of the transfer pump, I, which is connected therewith, and vice versa. Hence, the tubeing is kept continually full, whilst security is obtained by a safety valve on the pipe, N, fig. 1, as shown therein. These forcing pumps and the reservoir may be placed in any convenient station, their situation being quite immaterial. In another modification of the apparatus for producing steam as above described, the transfer forcing pumps, I I, fig. 1, are not employed; but the water is allowed to flow to the boilers from the tubeing or pipes, extending between N and K, and through the pipe, L, which last pipe is in this case directly connected to the pipe, K; the short branch, tubes, or pipes, that connect the pipe, L, with the boilers, are sometimes extended in length sufficiently for each to have a stop cock introduced thereon, by which the size of the passages, and consequently the supply of water, may be regulated. The deposited matters previously held by the water, suspended, or partly in solution, and the superfluous water, are carried forward by the agitators, and received by the tube or pipe, O, fig. 2, and are conducted by the tube, S, figs. 1 and 2, and occasionally admitted through the cock, No. 1. The passage of this cock is then closed, and the cock, No. 2, immediately opened, when the fluid contents between the cocks will be discharged, and steam supply its place. These cocks are to be opened and shut by the engine in any of the usual methods, and the boilers, without the aid of the engine man, are thereby kept clean, and the superfluous water discharged into a close vessel, E, and the steam that will separate from it is conducted through the dotted tube, shown in fig. 1, into the reservoir of cold water, G, where it is condensed, and its heat saved. The quantity of water injected is to be regulated according to the superfluous water discharged through O, by shifting the coupling rod that works the lever, T, of the said pumps, F F, and I I, into one or other of the pin holes provided in such lever. The connecting pipes between the boilers, as also the steam pipe, P, and the injection water pipe, L, form simple passages, as the drawings exhibit; or as they may have valves opening upwards, whilst the pipes, O, have their valves opening downwards, by which arrangement, in case of accident from the bursting of one boiler, the steam in the other is secured. In the first case, the passage of the water to the boilers is permitted without regulators; in the second case, the valves form regulators from their lift or degree of opening being extended or contracted, as the case may require, which is effected by the action of the screw, A, fig. 7; but when valves are not used, cocks are introduced for that purpose, if found desirable; and the steam pipes, P, should be furnished with a capacious and well constructed safety valve. These boilers should be made of scrap iron, without joint or rivets, with the exception of the end at which the agitators are introduced, and may be lined and coated, or not, with copper or other metal, to prevent corrosion. They may be used in any number, in the manner above shown, receiving their supply of water either after it has traversed the system of heating tubes (No. 1 to 5), or else directly by the forcing pumps from the reservoir, G. Another form of arranging the boiler, B, and tubeing, Nos. 1, 2, 3, and 4, is effected by placing the cylindrical boilers across or transversely to the furnace, and the tiers of tubeing or pipes likewise in the same direction, instead of lengthways of the fire-place, C, as we have shown by the figs. 2 and 3; but that part of the system of tubes or pipes which lines the sides of the fire place, should be continued in the longitudinal position, as described in the figures. In case of using transverse boilers and tubeing, the ends of the boilers, with the steam and water pipes, together with the shafts, *d*, and bevelled geering, which gives motion to the agitators, as seen in fig. 1, will, instead of projecting over the fire doors, at the end of the furnace, c, be ranged along the side of the furnace, and therefore out of the way of the person tending the fire. The contrary ends of the cylindrical boilers, B, will be supported by, and either project or not through, the other side of the furnace, sufficiently for the vertical tube or pipe, o, fig. 2, to be attached to them, either on the outside, or else within the furnace, or within the thickness of its walls, as occasion may require. The tiers of tubeing or pipes may be ranged across or transversely to the fire place, whether the boilers are in the same direction, or are placed longitudinally, with respect to such fire place; and the ends of such tubeing or pipes may be supported withinside the casing or walls which form the external parts of the flues and furnace, such casing or walls being composed of brick work, metal, or any other fit material; or the ends of such tubeing or pipes may be allowed to project through the sides of the furnace, so as to admit all the conical joints, (as shown in fig. 5, hereinafter to be described) to be in view; and likewise the connecting tubes or pipes, 5, 5, figs. 2 and 3, that form the passages from tier to tier respectively, so as to permit of adjustment when requisite. The ends of the tubes or pipes are represented in the drawing as being closed; but one or both ends of each of them, if desirable, may be secured with a screw plug, which can be taken out at pleasure, to allow the tubes or pipes to be cleared from time to time of any sediment or incrustations which may be deposited in them. We do not confine ourselves wholly to using these cylindrical boilers with agitators, but we sometimes apply them without agitators, filling them half, or any other fit degree of fulness, and cause them to receive their supply of water from the tubeing, as before-mentioned, or otherwise; and we sometimes arrange such cylindrical boilers in more than one tier, as circumstances may require. In either case they become much more effectual in the production of high or of low steam, than the immense boilers or magazines now in use, though our improved boilers seldom exceed twenty inches in diameter for low steam, and decrease from that to ten inches, or under, in proportion to the height or strength of the steam required to be generated; and hence they are not only rendered far more secure, but require much less room than the boilers now in use. The tiers of boilers and tubes or pipes, Nos. 1, 2, 3, 4, as shown by the sections, figs. 2 and 3, form the bottoms and tops of flues successively, which flues are very shallow in depth, and are floored with fire clay or loam, or any other fit material, and they extend the whole width of the furnaces, whereby the hot air and vapours are thereby spread, and the caloric is much more effectually taken up by the water than if conducted in a square volume, more especially as the water contained in each tier of pipes upwards decreases in heat, as they approach the place, N, of injecting the new supply; and the diminishing heat of the volume of air and vapours in their passage from the fire through the flues being then brought nearly in contact with water, proportionally increasing in coldness, such air and vapours continue to give out their heat to the said water until their final discharge into the chimney, U. Fig. 4 is an horizontal section through the centres of a tier of tubes or pipes, and shows the manner in which the tubes or pipes are connected together. Both ends of each tube are closed, and a conical hole bored in the contrary side at each end, in which holes are fitted hollow double cones, that form the passages between each pair of ends. These cones are made of copper, or other suitable metals, and being ground into their holes or seats, render the joints completely tight. Fig. 5 shows one end of a tier of tubes or pipes, and exhibits the method of securing these conical joints: B is an oblong square, formed of any suitable metal, of any desirable thickness and width, having the strong screw, D, tapped into the end. After the ends of a tier of tubes have been introduced into the opening of the frame, having alternately the hollow double cones, and the curved blocks, *a a*, properly adjusted between the tubes, as seen in the figure, this one screw will be fully equal to the forcing and retaining of the whole of the cones in their places. For increasing the effects of the coals, wood, or other ordinary fuel, used in generating steam in boilers on board boats or vessels, or in carriages, to be propelled thereby, we sometimes mix with, add to, or sprinkle upon the said fuel, either tar, pitch, or any resinous or inflammable substances, either mineral or vegetable. To elucidate the principle on which our engines act for employing the power of steam operating expansively, we refer to fig. 6, which may be supposed to represent a cylinder, 27 feet high, and one inch area in the bore. On the left hand is written the number of feet, commencing at the bottom; and opposite, on the right, are the comparative degrees of power that steam, of 500lbs., presses on each square inch, is capable of exerting at each expansion, (taking the contractions and expansions of steam by variations of pressure in the same ratio as those of air). Now suppose the first foot to be filled with steam of 500lbs. per inch, and that no more steam be allowed to enter, the result would be that it will expand and lift the piston until it fills the whole cylinder in a decreasing ratio of power, as shown by the figures on the right. These figures, added together, produce the aggregate amount of 1939 pounds weight, which one foot of such steam, by its expansive action, is capable of lifting one foot high; but it is manifest that so applying high steam in one cylinder is not useful to practicable purposes, because of the very great difference in its mechanical force when near to the commencement, and when near to the termination of the stroke of the piston. Therefore, to obviate this, and partly equalize the power, we add two or more cylinders, as the case may require, increasing and apportioning the area of each succeeding cylinder to the diminishing power of the steam. Thus, if a non-condensing high pressure

Fig. 1.

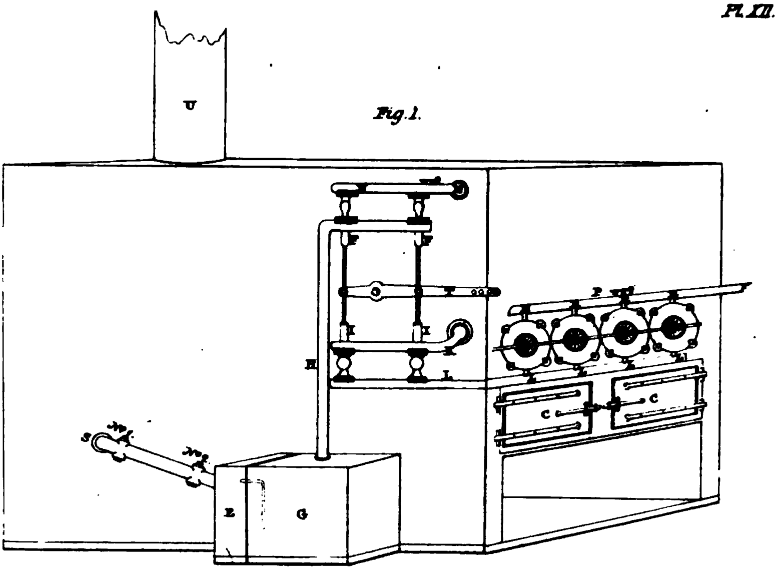


Fig. 6.

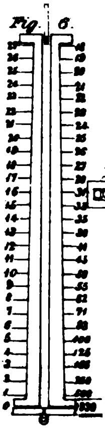


Fig. 4.

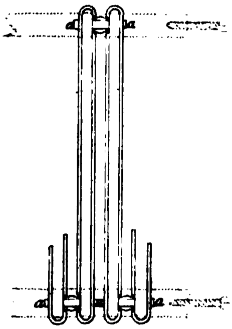


Fig. 5.

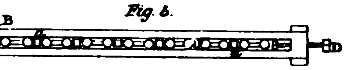


Fig 7.

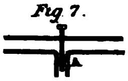


Fig 2.

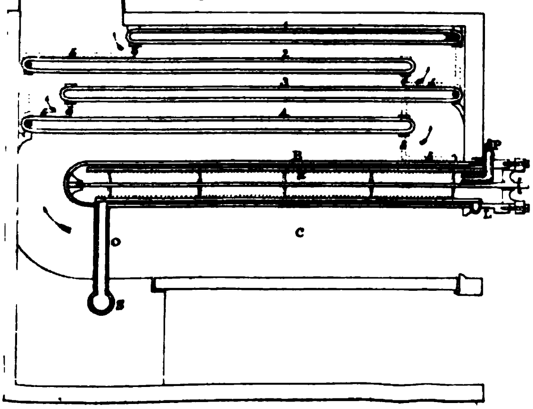
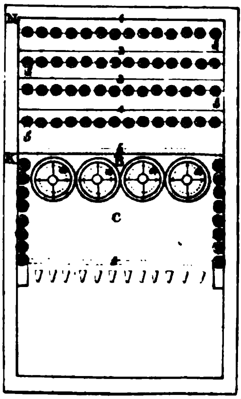


Fig. 3.



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engine, with two cylinders, be required, allowing the waste steam to escape into the atmosphere, or otherwise employing it, we fill the first cylinder in part only, or else wholly, from the boilers, until the piston in the first cylinder has reached its limit, according to the strength or power at which it is intended to generate the steam; and when the piston in the first cylinder has reached its limit, according to the strength or power at which it is intended to generate the steam, and when the piston in the first cylinder has performed its stroke, a communication is then opened between that and the second cylinder, against the piston of which it acts expansively. The first cylinder having become, as it were, a steam chamber to the second, these two pistons may either, 1st, move together in the same direction, or else, 2d, they may move in contrary directions. In the first case, viz. when the two pistons move simultaneously in the same direction, the steam from the boilers is admitted above the piston in the first cylinder, and presses on its top, whilst the steam beneath this piston (which was admitted from the boilers in the previous ascending stroke), from its expansive power passes through a communication then opened to the upper side of the piston in the second cylinder, which it presses downwards at the same time, in conjunction with the first piston, and vice versa. In the second case, viz. when the pistons at the same time are one going down and the other up, the steam from the boilers is acting upon the top of the first piston, whilst the steam (previously admitted) beneath this piston is expanding against the under side of the second piston, and pressing it upwards. This decreases the resistance (as in the above-mentioned case) on the under side of the first piston, and occasions it to be carried downwards at the same time by the steam flowing from the boilers, and vice versa. In the foregoing descriptions of the expansive use of high steam in two cylinders, without condensing the first half of a complete stroke (up and down, or down and up), or so much of the operations connected with a complete stroke by the piston, are detailed as are common to a single acting engine, and also to a double acting engine; and by the phrase vice versa, as used above, the reversed operations in the last half of a complete stroke, necessary for completing a double acting stroke, are intended. But when, instead thereof, a single acting stroke is required, then, at the end of the first half of a complete stroke (that is, when the piston was either gone up or down, but not returned), the connections with the boilers, and also with the atmosphere, are to be cut off, and other communications are at the same moment to be opened between the top and the bottom of each cylinder respectively, in order that the descent of the counter weight (whether this consists of pump rods or any other lead), on the opposite end of the beam, may displace the steam in each cylinder, and cause it to occupy the opposite ends thereof, ready for repeating the operations already described. As a further improvement on engines to be wrought by steam, we attach a forcing pump or pumps to the boiler or boilers, or to the steam pipes, or any chambers connected with the boiler or boilers, for the purpose of frequently proving their strength, by forcing water into all or either of them, until the water lifts a safety valve or valves, loaded in any requisite degree.

In the drawings hereunto annexed, and in the foregoing descriptions, we have shown and described several parts and things, which are already known and in use, respecting which parts and things, singly and apart, we lay no claim of invention or exclusive use, but only as such parts and things are or may be combined and applied for carrying our said invention into effect, in the manner hereinbefore described.

And we do hereby expressly ascertain and limit our claims under the hereinbefore in part recited patent, to the following particulars, (that is to say):—First, we claim the principle of spreading thin sheets of water, by means of revolving agitators, over the internal surfaces of cylindrical boilers, when placed horizontally, or but moderately inclined, in the modes hereinbefore described. Secondly, we claim the particular arrangements of the tube lined fire place and flues, which are shown in figures 1, 2, and 3, and described herein, with their several modifications that are mentioned, for the purpose of heating the water, previously to its being introduced into our boilers. Thirdly, we claim the mode of connecting and joining together our tubes or pipes in each of the tiers, which is shown in figures 4 and 5, and described herein. Fourthly, we claim the having of a forcing pump or pumps constantly attached to the boilers, or steam pipes, or chambers, for the purpose of readily proving their strength on all necessary occasions. Fifth, we claim the applying of tar or pitch, either mineral or vegetable, to increase the inflammability, and perfect the combustion of ordinary fuel used for the generating of steam. And sixth, we claim the principle of using high steam in two or more steam engine cylinders without condensing (to assist our engine by the vacuum formed thereby), in the manner hereinbefore described.

In witness whereof, &c.

Specification of the Patent granted to CHARLES CHUBB, *of Portsea, in the county of Southampton, Ironmonger, for an improvement in the construction of locks.* Dated June 15, 1824.

WITH AN ENGRAVING.

TO all to whom these presents shall come, &c. *Now know ye*, that in compliance with the said proviso, I, the said Charles Chubb, do hereby declare that the nature of the said invention, and the manner in which the same is to be performed, are particularly described and ascertained in and by the drawings which are hereunto annexed, and by the following description thereof, (that is to say): My said improvement in the construction of locks is applicable only to that description of locks generally known under the denomination of Chubb's Patent Detector Lock, and for which letters patent were granted to Jeremiah Chubb, of Portsea, bearing date at Westminster on or about the third day of February, in the fifty-eighth year of the reign of his late Majesty, King George the Third, and in the year of our Lord one thousand eight hundred and eighteen;* and in order that the application of my said improvement may be distinctly understood, I will first briefly describe one of the said patent detector locks, furnished with what the patentee denominated detecting mechanism. The detector is a detent or lever, moving upon a fixed centre pin, being formed with a hook or catch, adapted to interlock with a notch or stud in the bolt of the lock, so as effectually to stop and resist the motion of such bolt, whenever the detector is moved on its centre pin so as to come into contact with the bolt; but if the detector is moved on its centre pin so as to be clear of the bolt, it will then make no opposition to its motion. The detector spring is a spring applied to the detector in such a manner as to urge its hook or catch towards the bolt, when the detector is moved, so as to bring the said hook or catch nearer to the bolt than a certain position which may be called the point of detection; at the same time the said detector spring will urge the detector hook away from the bolt, whenever the same is at a greater distance from the bolt than the said point of detection. The detector is so placed as to be operated upon by the tumblers of the lock when the whole or any of them are raised; and if any of the tumblers is raised too high, (that is to say,) is moved further from the centre of motion of the key than the required position in which the notch in such tumbler comes opposite to the stud of the main bolt (in order that the main bolt may pass to open the lock), then such tumbler which has been too much raised will move the detector beyond or within the point of detection, in which case the detector spring will throw the hook of the detector into contact with the bolt, and the detector will thereby effectually stop any motion of the bolt, even though the tumbler which occasioned the detection should be restored to its proper position. For though any one of the tumblers which may be raised too high will operate against the detector to throw its hook into the notch in the bolt, yet there is no connexion between such tumbler and the detector, which can occasion the detector to leave its then position. As the true key of the lock will raise each tumbler to its required position, and no further, it will never throw the detector beyond or within the point of detection; consequently, the detector spring will always keep the detector hook disengaged from the bolt; but if a false key or a picklock be employed to raise the tumblers, there will be every probability that some one will be raised too high, and will move the detector beyond the point of detection, so that the detector spring will then throw the hook into contact with the bolt. In this state the lock is what is called detected, and the possession of the true key has evidence that an attempt has been made to violate the lock, because the said true key will not now open it; for neither the true key or tumblers have any means of communication with the detector after it has passed within the point of detection. The remaining parts of the detecting mechanism are for the purpose of regulating the lock, or releasing its bolt from the hook of the detector. They are as follows:—The regulating bolt is a slider within the lock adapted to operate upon the detector in such manner as to raise or remove the hook thereof away from the bolt of the lock beyond the point of detection, and it is operated upon by an adjusting instrument, which is called the regulating key, which may be similar in form to other keys, but so made as not to open the lock, it being designed only to discharge the detector, and regulate the lock, by restoring its parts to such a state of adjustment that its own key will open it. For this purpose the regulating key has a different arrangement of the steps on its bit, one of which shifts or moves the regulating bolt. The regulating bolt may be placed over or under the bolt of the lock, and has a pin or stud which projects from it, and applies against the tumblers of the lock, which are adapted to resist the motion of this regulating bolt, unless each one of the said tumblers is raised or moved into a given position, and neither more or less, by means of the several steps in the bit of the regulating key. The regulating key being applied in its place in the lock, and turned partly round, its several steps will first raise each tumbler to its exact required position, and then it will move the regulating bolt, by which means the detector will be moved without or beyond the point of detection, and the detector spring will throw the hook of the detector out of the reach of the bolt, which may be effected by a small inclined plane or wedge upon the regulating bolt. By this means the lock will be regulated or restored to its original state, and can be opened by its true key. In another part of the said Jeremiah Chubb's specification, he described a plan whereby the same key may be made to serve for the true key and for the regulating key, by changing its position in the lock. This he effected by having a small middle plate situated within the lock, having two key holes formed through it at right angles to each other, which operated as follows:—When the lock had been detected by an attempt to violate it or by any other means, the true key was to be introduced into the key-hole, and after being turned one quarter round upon its pin it was to be drawn outwards or away from the main lock plate until its bit passed through the second key-hole, formed in the middle plate before-mentioned. The key was then turned partly round, in which position the steps upon its bit would operate upon the tumblers and regulating bolt in a proper manner, to regulate or restore the lock to its original position: and when this had been effected the key was to be pressed inwards, and returned into its proper position for opening the lock. All the methods which were described by the said Jeremiah Chubb, for regulating or restoring the state of the lock when it had been detected, were found to be attended with inconveniences, to obviate which has been the entire object of my present improvement, as will be hereinafter fully described. Figs. 1 to 6 (inclusive) upon the sheet of drawing which is hereunto annexed, (Pl. XIII.) represent a lock with its parts, adapted for a door. It is provided with four tumblers, and is furnished with the aforesaid detecting mechanism; but the regulating part is constructed according to my present improvement. Note, the same characters or letters of reference are used to denote corresponding parts upon the figures whenever they occur: 1, the centre pin, upon which the detector moves; 2, the tail or end of the detector, proceeding nearly down to the tumblers B; 3, the hook which detains or holds the main bolt, by falling into the notches 4, cut therein; 5 is the detector spring; it is formed into a triangular piece, at the end which acts against the detector, the end of which is also made in a triangular form. Now if the proper key is introduced into this lock, it will raise the tumblers, B, upon their centre of motion, D, exactly to the required height for the stud, *b*, (upon the main or locking bolt, A), and the stud, 10, (upon the regulating bolt, 7), to pass through their respective openings in the tumblers, as seen in fig. 1 upon the annexed drawing, and thereby the main bolt may be withdrawn or unlocked. But if any false key or other instrument should be introduced into this lock, for the purpose of opening or picking it, by which any one or more of the tumblers, B, should be raised too high, they will also raise the end, 2, of the detector, and depress the end, 3, until the inclined plane or triangular piece of the detector falls under the triangular piece of the spring, 5; then the hook, 3, will be instantly shot into one of the notches, 4, on the main bolt (as shown at fig. 2, where the lock is represented in a locked position), and will retain it so effectually, that the application even of its proper or true key will have no effect to withdraw the main bolt, nor can the same be moved until the detector has been returned to its original position as aforesaid. I have above described the nature of Jeremiah Chubb's detector lock sufficiently to be enabled to explain clearly to persons conversant with works of a similar description, how my present improvement is to be applied thereto. And I, the said Charles Chubb, do hereby declare, that I make no claim to that detecting mechanism which I have above described, it having only been introduced into this my specification, to show clearly the application of my present improvement; but I confine my claim entirely to the following particulars, that is to say:—I form and apply the regulating bolt in such manner, that the proper or true key which is used to lock and unlock the lock, may also perform the office of relieving the detector to regulate the lock, when it has been detected as aforesaid; and that by simply turning the said key partly round upon its centre pin, in the same direction that it is turned in the act of locking or throwing the main bolt, as shown by the direction of the small dart or arrow in fig. 2. This improvement is effected in the following manner:—The regulating bolt, 7, which is shown in fig. 3, upon the annexed drawing, as laying over the main bolt, A, is adapted to move or slide backwards and forwards along with the main bolt, in the act of locking and unlocking the same, for which purpose it has a groove or opening cut through it, which slides upon the stud, D, in the same manner as the main bolt does. The regulating bolt has also an opening formed through it, for the stud, *b*, of the main bolt to pass through; and this opening is of such length in the direction of the bolt's motion, that the regulating bolt, 7, can slide forwards in a slight degree upon the main bolt, A, even after the main bolt has been fully shot or locked; and it is this extra sliding motion of the regulating bolt upon the main bolt which operates to regulate the lock, or return the detector to its original position,

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* See Repertory, Second Series, Vol. xxxiv. p. 321.

Fig. 1.

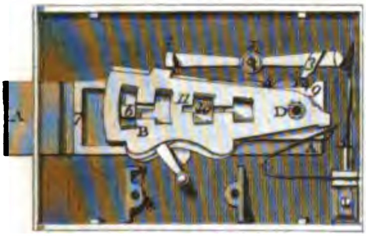

Fig. 2.

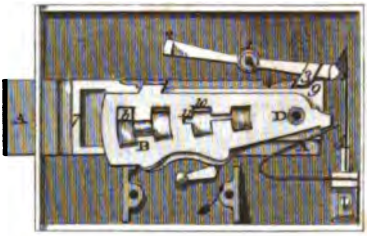

Fig. 3.

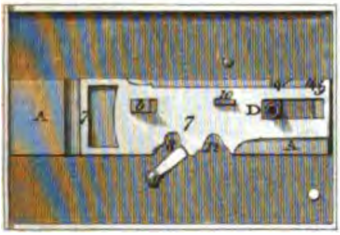

Fig. 4.

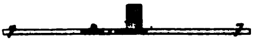

Fig. 5.

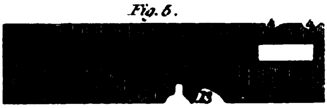

Fig. 6.

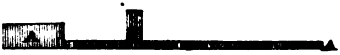

Fig. 7.

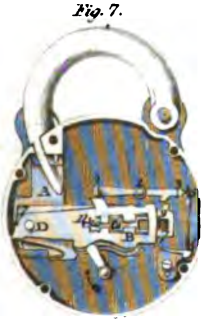

Fig. 8.

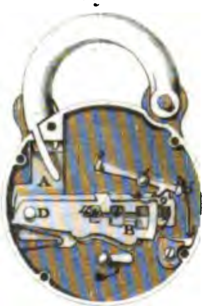

Fig. 9.

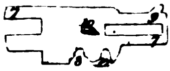

Fig. 11.

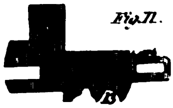

Fig. 10.

Fig. 12.

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after the lock has been detected by any means as aforesaid. When the lock is in the act of locking and unlocking, the regulating bolt, 7, is caused by the motion of the key to slide backwards and forwards along with the main bolt, by means of a notch, 8, which is made in its side for the bit of the key to take into, similar to the notch in the main bolt. Now if an attempt is made to violate or open the lock, and by that means the lock should become detected, as shown in the fig. 2, its proper or true key, on being introduced and turned round in the right direction for unlocking or withdrawing the main bolt, will be found not to perform its office, since the main bolt will be retained firmly by the hook, 3, of the detector, and will thus intimate to the proprietor of the lock that an attempt has been made to pick it, in which case he must slide or move the regulating bolt, in order that its inclined plane or wedge, 9, before-mentioned, may force back or relieve the hook, 3, of detector from its hold upon the main bolt. To effect which, he has nothing to do but simply to turn the key in a backward direction, or in the same direction that it is turned in the act of locking or shooting the main bolt, as shown by the small dart or arrow in fig. 2, by which means the various steps upon the bit of the key will first raise the different tumblers, so that their openings, 11, will correspond with each other sufficiently to permit the stud, 10, upon the regulating bolt to enter; then, by continuing to turn the key round a short distance further in the same direction, its bit will enter the second notch, marked 12, in the side of the regulating bolt, 7, and will advance or move the said bolt in a sufficient degree for its inclined plane or wedge, 9, to relieve the detector from its hold; after which the key, on being turned round in the proper direction for withdrawing the bolt, as shown by the arrow in fig. 1, it will open the lock. Note, the main bolt has two notches cut in its side, as shown in the figs. 5 and 6, which represent two views of the main bolt, as detached from the lock. The second notch in the main bolt, marked 13, is made wider than the notch marked 12 in the regulating bolt, in order that the bit of the key, when moving the regulating bolt forwards, in order to return the detector, might not act upon the main bolt. This improvement, by enabling the true key to be employed in such a simple manner for regulating the said patent detector locks, is found to possess considerable advantage over the modes which were heretofore known and in use, and will, it is presumed, render those locks more generally useful. The said improvement is equally applicable to all descriptions of the patent detector locks before-mentioned, and may, from the description above given, be easily adapted to them, by persons conversant with such works. Figs. 7 to 12 inclusive, upon the annexed drawing, represent a padlock, with its tumblers and appendages, being provided with detecting mechanism, similar to what has been hereinbefore described, and with the regulating part, constructed according to my aforesaid improvement. The same characters or letters of reference which are used upon the various parts of this lock, will be found to correspond with those marked upon similar parts in the figures of the door lock. And since its operation is nearly similar, it will not be necessary to enter into a minute description of it; observing, that the form and proportion of the different parts may be varied according to the discretion of the workmen employed in constructing the same. The materials of which the same may be made may also be varied according to the circumstances of the case, without departing from the object of the invention, as hereinbefore described and set forth.

In witness whereof, &c.

Specification of the Patent granted to Joseph Manton, *of Hanover-square, Middlesex, Gun-maker, for a certain improvement in shot.* Dated March 25, 1825.

TO all to whom these presents shall come, &c. &c. *Now know ye*, that in compliance with the said proviso, I, the said Joseph Manton, do hereby declare that the nature of my said invention, and the manner in which the same is to be performed, are particularly described and ascertained as follows, (that is to say):—My said invention of a certain improvement in shot, is applicable to the lead shot commonly used in fowling-pieces for killing game, and other purposes, and consists in coating the surface of the shot with the metal called mercury, or quicksilver, whereby it is rendered white, much more convenient for use, more cleanly, and not so liable to injure the quality of the game killed by it, as when prepared in the usual manner, nor to adhere to the barrels of fowling-pieces; and I hereby claim as my invention, any and every mode by which lead shot may be coated with mercury or quicksilver. As, however, it is desirable that I should afford an example of a method or methods of carrying my said invention into effect, I shall proceed to do so as follows: I take the lead shot, in preference before it is glazed with plumbago or black lead, and put it into a vessel, either of a globular or barrel shape, which can be closed, and which I prefer to be made of iron, and capable of receiving either a revolving movement on an axis, or of being agitated backwards or forwards, or in any other fit or proper manner. Into this vessel or vessels, I put about one hundred pounds' weight of lead shot, and about one pound of mercury or quicksilver, and nearly fill it with water. I then briskly stir or agitate the whole together, until I find, on trial, that the whole of the mercury or quicksilver has spread and diffused itself uniformly, and coated the surface of the shot, after which I wash it well in water. I then spread the shot upon a cloth or canvas, which is stretched on a frame of wood, and rub the shot with a sponge or cloth, which will make it dry quicker. Should the shot lose its silvery colour by being kept a long time, it may be restored by again putting it into a revolving vessel, or one capable of being shaken or agitated, together with some water, and a little mercury or quicksilver, and be treated as before-mentioned.

In witness whereof, &c.

Description of a Quadruple Lock, for securing iron safes and chests.

By Mr. J. Duce, Wolverhampton.

From the Transactions of the Society of Arts, &c. Vol. xlii.

The Silver Vulcan Medal, and Ten Guineas, were presented by the Society to Mr. Duce for this invention.

WITH AN ENGRAVING.

This lock, with a single turn of the key, throws out four bolts, one at right angles to each side of the lock; and will, therefore, prevent any door to which it is applied from being opened, even if the hinges have been cut away. If to this be added the great difficulty (probably the impossibility) of picking it, the security offered by it is as great as can be effected or desired.

Locks for safes, which throw out three bolts at once, have been made by various persons, but such locks are only single ones, with the modification of having three bolts instead of one. A lock, therefore, of this description, offers no more difficulties in the way of picking it than are presented by a single-bolt lock of the same construction.

Mr. Duce's lock, however, is a combination of four distinct single-bolt locks, fixed in the same frame and opened by the same key; the bolts, therefore, are shut or withdrawn in succession, and present the two following advantages. Whatever time and trouble may be required for picking one of the locks must be quadrupled before the whole can be opened; and as the key opens the four locks in succession, the strain on the wards will be much less than in those cases where two or more bolts are moved simultaneously.

Independently of the ingenious manner in which the four locks are combined, there is not much of novelty in the invention. The tumblers are on Chubb's principle, without the detector, and the rest of the lock is on Barron's principle.

Fig. 1, (Pl. XIV.) *o o* the case, *p p* the first bolt, *q q* the second, *r r* the third, and *s s* the fourth bolt; the upper plate is removed, and the lock rests on the inner casing, *t t t t; u u u u* an inner plate, *v v v* three tumblers lying on it for the three first bolts; beneath each of these tumblers, and under the plate *u u,* are two more tumblers, making three for each of these bolts; the last bolt, *s s,* has but one tumbler, *w,* placed under the plate *u u,* which is moved by the corners of an intermediate piece, *x x,* which turns on the pin, *y,* as is shown by dotted lines. The key, *z,* is represented as having thrown out the first bolt, *p,* and beginning to protrude the second, *q*; it then acts on the bolt *r,* and lastly on the bolt *s,* moving them to places shown by dotted lines. It withdraws the three first bolts in a reverse order, but finishes with the last, *s s,* in either case.

Fig. 2. The key.

Description of a new Remontoire Escapement, by which the motive force is transmitted to the escapement uniformly, and without impeding the vibration of the Pendulum. By MR. J. AITKIN, *of St. John-street, Clerkenwell.*

From the Transactions of the Society of Arts, &c. Vol. XLII.

The sum of Twenty Guineas was given by the Society to Mr. Aitkin for this invention.

◆

WITH AN ENGRAVING.

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Fig. 3, (Pl. XIV.) is a view of the escapement, having the front plate removed.

Fig. 4 is a side view.

Fig. 5 is a longitudinal view of the axis of the escapement-wheel, and a section of its appendages.

(The same letters refer to the same part in each figure.)

A A Is the front plate, and B B the back plate, the lower part of which is represented as broken off: the dotted circle, D, represents the fuzee-wheel, which works into the pinion *e*.

E Is the second wheel, which is fixed on the axis of the pinion *e*, and works into the pinion *f*.

F The third wheel, which is fixed on the axis of the pinion *f*, and works into the pinions *g* and *h*.

G The escape wheel; H the palettes.

The pinion *h* is fixed on the axis *i i*, and also eight spring detents, *j*, *k*, *l*, *m*, *n*, *o*, *p*, *q*, the ends of which rest against the cylindrical side of the axis, *r r*, of the escape-wheel, and escape through the notches 1, 2, 3, 4, 5, 6, 7, and 8, in succession, as the axis *r r* turns round.

The position of the gaps, in the side of the axis *r r*, is represented in fig. 6 by the figures 1, 2, 3, 4, 5, 6, 7, and 8.

The axis or arbor, *r r*, on which the escape-wheel is fixed, passes through a cylindrical hole in the pinion *g*, and is at liberty to turn freely within it.

s Is a collet, which is fixed on the socket of the pinion *g*.

Fig. 7 is an end view of the collet *s*, together with the helical spring, *t*, one end of that spring being fixed to the collet *s*, and the other end to the collet *u*.

Fig. 8 is an end view of the collet *u* : this collet is fixed upon the arbor *r r*, by the set screw *v*, and by means of it the spring *t* may be wound up to a proper strength, so as to overcome the friction of the axis *r r*, and cause the escape-wheel, G, to turn round. When the clock has been wound up, the pendulum put in motion, and the axis, *r r*, of the escape-wheel has turned one-eighth round, the detent, *j*, will be at liberty to pass through the gap, g : then the wheel, F, will cause the pinion, *h*, together with the detents, to turn one-eighth round; consequently, the detent, *k*, will be turned till it rests against the cylindrical side of the axis, *r r*, opposite to the gap, 7 ; the wheel, F, will also at the same time turn the pinion, *g*, together with the collet, *s*, one-eighth round, which will rewind the helical spring, *t*, and give sufficient power to the escape-wheel, *g*, to make one-eighth of a revolution more by the unwinding of the spring; the detent, *k*, will then be at liberty to escape, and the wheel, F, will again cause the pinions, *h* and *g*, to turn one-eighth round, and at the same time the helical spring will be again wound up.

In this instrument the swing-wheel acts with an equal force, when the motive power is even doubled, without affecting the isochronism of the pendulum. This is not the case in the clocks hitherto constructed by Mudge, by Cumming, and others of a later date; for all those, more or less, are affected by the irregularity of the train, and therefore the pendulum is more or less disturbed by the unlocking of the detents.

Those who possess clocks on the remontoire principle, as hitherto constructed, will find, on trial, that by adding a double weight, the irregularity will increase, or rather the clock will stop altogether. But an increase of weight will not stop my time-keeper, nor cause any irregularity in its motion. They will also have the mortification to find, on trial, that the usual dead beat escapement is absolutely preferable to those elaborate escapements.

An objection may arise respecting my contrivance, namely, that the renovating spring, in its unbending, is weaker than when bent up; but these inequalities are constantly the same every 6″, and therefore do not destroy the isochronism of the pendulum. It would, perhaps, be better to have ten notches in the cylinder, in which case the spring would be unbent once in 6″. The notched cylinder may be about the tenth of an inch in diameter.

Proposal for constructing a Grooved Stone Tunnel under the Thames, to be put down by means of strong coffers. By ALBEDO.

Abstracted from the Papers and Documents of the "THAMES ARCHWAY COMPANY."

WITH AN ENGRAVING.

HAVING considered the various ways by which tunnels may be constructed under rivers, and weighing the difficulties against each other, I am of opinion that a tunnel made through the river would be preferable, and less expensive, than an under-ground one, where it can be formed without any material impediment to the navigation; because dangers and difficulties which will, from quicksands and unforeseen things, arise, and which require the utmost precautions of the engineer to guard against, would be easily overcome, and the depth of the strata between the top of the tunnel and the bed of the river would be considerably less than required for an under-ground plan; consequently, the ascent of the tunnel must be less, and the line shorter.

The plans herewith submitted to the inspection of the Thames Archway Company, are for the construction of a tunnel in the bed, and through the river, of sufficient

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Fig. 4.

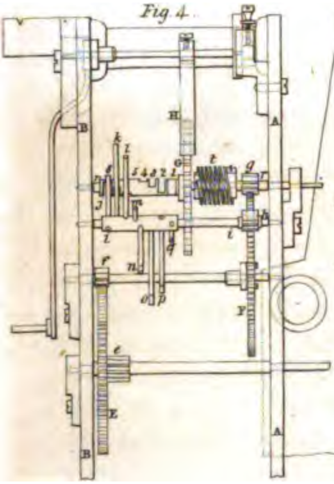


Fig. 3.

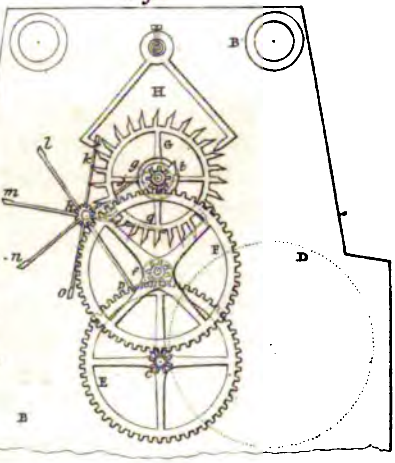


Fig. 6.

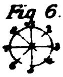


Fig. 5.

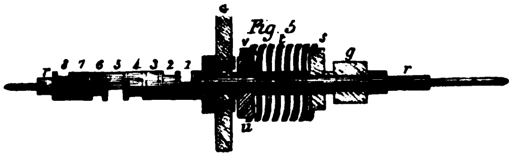


Fig. 8.

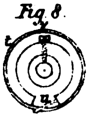


Fig. 7.

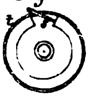


Fig 9.

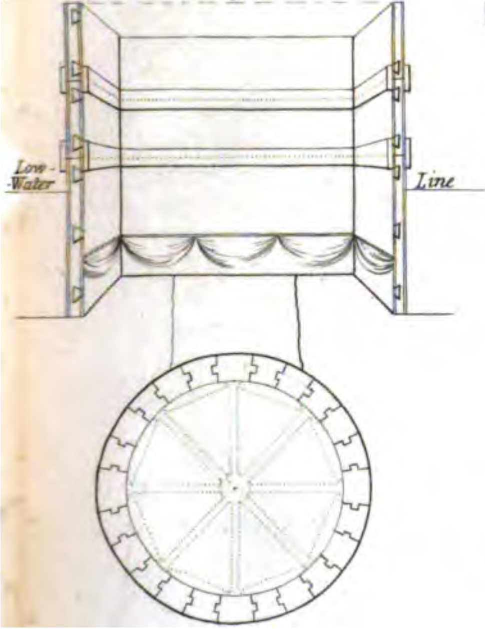


Fig. 2

Fig 1.

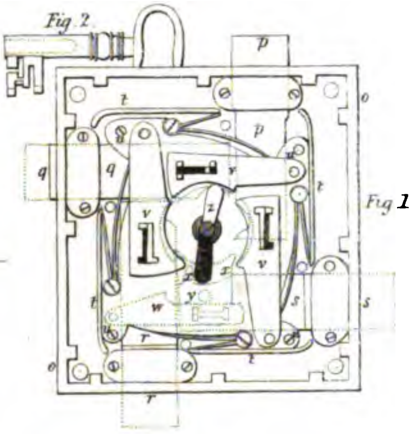
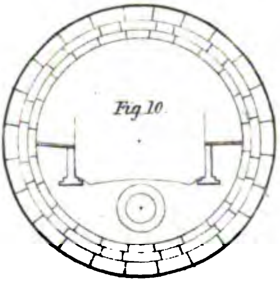


Fig 10.



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extent to admit of two carriages to pass each other, with a terrace or footway on each side, wide enough for three persons to walk abreast, which no doubt can be executed with certainty in any line within the given space, I conceive no advantage will be gained by removing it. I shall therefore propose the line already laid down, and for which the driftway can be converted into a drain, and the work carried into effect with very little, if any, impediment to the navigation of the river. The interior of the tunnel is a matter of fancy. A footpath on one side, of double the width, or one in the centre, and the carriages to pass on each side, raised about 10 inches above the carriage-way, may answer every purpose, and save considerable expence. But the terrace will be far preferable, as the footways will gain about 6 inches each in width, without diminishing the carriage-way, and be a much greater security for passengers. The top of the tunnel on this plan will be on the average about 5 feet under the bed of the river, in some places more, in others not so much; and the work will occupy a space of about 40 feet in the river, which will be little or no obstruction to the navigation.

I propose lighting the tunnel with gas, on Mr. Windsor's principle. The expence of completing the said works, agreeable to the plans, is estimated at one hundred and twenty-two thousand pounds. The tunnel may be enlarged or diminished if thought proper, which will of course enlarge or diminish the expence.

The proposed tunnel is to be built of key stones, 4 feet thick, in a gun-barrel form, 27 feet wide in the clear; the drain to run from the centre of the tunnel to the shaft already sunk on the South shore, to be worked in the driftway already got through. The length of the carriage way is 1183 feet in the tunnel; from the end of the tunnel to the surface on the South side, 122 feet; and on the North side, 93 feet, making the whole line of carriage way 1398 feet.

Fig. 9 (Pl. XIV.) is a transverse section of the tunnel and frames or coffers, as more particularly described in the specification hereinafter-mentioned, with the tunnel planked and dammed up, ready for the carrying forward the frames; and also shows the method of grooving the stones into each other lengthways.

Fig. 10 is a transverse section of the tunnel, showing a section of the interior road and foot-ways and drain, and the transverse grooving the stones together.

A Specification *of the several works and apparatus necessary for a Tunnel under the river Thames, agreeable to the Plans herewith exhibited.*

1st, A steam-engine of 18 or 20-horse power, capable of keeping two pumps constantly at work, and of drawing up the soil as it shall be excavated from the bottom of the river, is to be erected in a lighter.

Then strong frames or coffers, 40 feet square, made of oak, or sound Riga or Memel timber, 10 inches square at the least, strongly framed and bound together with iron bolts and straps. The timber to be properly squared, so as to form a close joint. The first, or bottom frame must be 20 feet high; the other two frames 10 feet high each, to admit of being moved with greater ease; to be boarded inside and out with sound two inch plank; the seams or joints to be caulked and made water tight, the same as the sides of a ship, and then pitched. They must also be made with grooves or rabbets, so as to fit one on the other properly close, which grooves or rabbets must also, when the frames are fixed, be caulked and made water tight, and pitched. It would be best to put these frames together on barges, for the purpose of being easily launched.

The engine and frames being complete, the workmen may proceed to work, first opening the ground in Mr. Burr's yard, on the South shore, digging to the depth of the bottom of the tunnel at that place, which will be about

48 feet, taking care to plank and shore up the sides as they go down; the opening to be about 16 feet, to be enlarged as the stones are laid in.

The tunnel being this way worked, until it comes near the water's edge, the bank of the river is then to be notched in, to admit of the first frame, of 20 feet high, so far in as to be about 5 feet over the work already done. This is to be fixed at low water, and the bottom on the inside to be dammed up and made water tight with clay, or other materials best for that purpose. The engine in the lighter is then to be brought up with the tide, and moored alongside the frames, to draw off the water, should there be any leakage or springs to incommode the workmen, and to draw up the soil as it is excavated.

It may be found necessary to have something to fix the frames to prevent the tide shifting or moving them; in which case a few piles must be driven into the ground, at proper places, to which they are to be made secure.

The ground being excavated, and the tunnel got in, it must be covered over 2 feet thick with clay, properly tempered and rammed hard, over which chalk and gravel must be laid, and rammed as hard as possible, until up to the original level. This must be continued on the top of the tunnel all through the river. This being done, the piles are to be drawn and the frames brought forward, leaving about 5 feet over the end of the work. The piles are then to be driven, the bottom secured, and the work to proceed as before.

The work will go on in this way for 3 or 4 frames, until the river becomes deeper, and the work got forward to low-water line, after which it will be impossible to fix the frames dry. Then the first frame must be sunk at low water, and the other frame or frames (as the height of water may require) must be fixed on and caulked as before directed. And as in all probability the frames will not stand level on the bed of the river, which no doubt is higher in some places than in others, consequently the water will come in faster than the engine can draw it out. To obviate this difficulty a curtain, of sufficient length to lie 3 or 4 feet on the ground, made of sail cloth, properly tarred, the bottom to be loaded with iron or lead weights, must be fixed to the inside of the first frame, as shown in fig. 9 in the plans, which must be drawn up with cords while sinking.

When the first frame is fixed in its proper place, the curtain must be dropped, after which a quantity of clay, in bags or otherwise, as may be found best, is to be thrown in all round the inside of the frames, until the bottom is secure. The engine will then draw out the water, and the workmen, after further securing the bottom, may proceed as before. When the work is got down to the bottom of the descent, it will be proper to make the drain as hereinafter directed, which is to be continued with the work to the centre of the tunnel; and afterwards, in a temporary way, along with the work. This will draw off the water, and assist the floating engine.

These operations are to be repeated until the work is got forward to the holes. And if the quicksands should run deeper than the bottom of the work, piles must be driven, and gravel and chalk stones well rammed in, until a solid foundation is obtained, which, if necessary, must be planked. Should the sands come in sideways, wooden dams must be formed and sunk in the earth on the outside of the work. By these means, and proper precautions, the tunnel will be formed through the river to the North shore, at which place the workmen will act in the same manner as before directed, in Mr. Burr's yard, on the South shore.

The end of the tunnel, as shown at fig. 9 in the plans, must be planked and dammed up at every length before the frames are moved, to prevent its being choked up. The tunnel, being worked through the river, is to be finished in the same manner at both ends.

The mason must take great care in selecting the hardest and best stone for this purpose, to be properly guaged, jointed, and grooved into each other, as shown by plans, figs. 9 and 10, and to be set in cement impervious to water. The stones must be properly worked and fitted to each other before they are brought to the work, that they may go together directly without any trouble.

A brick gun-barrel drain, 3 feet wide, and 9 inches thick, inside the tunnel, is to be carried in the same direction as the tunnel from the centre to the rise, where it must go through, and from hence be made 18 inches thick to the driftway, which must be sunk lower towards the shaft, to give it a proper current.

INTERIOR OF THE TUNNEL.

The stones and drain are to be covered first with clay, then with loam, and on the top with gravel, until it is 9 feet high to the level of the carriage-way; these are all to be rammed and rolled down as hard as possible.

The bricklayer is to build a 9-inch wall, with proper footings, 3 feet 8 inches high from the level of the carriage-way, and 5 feet 4 inches high from the arch, sideways, to the outside of the wall at top. The wall to be built of sound hard-burnt grey stocks, laid with a neat flat joint, jointed and well flushed up. The space between the arch and this wall is to be filled in level to the top with earth.

The pavier is to lay the terrace or footway with York paving, two inches higher on the inside than on the out, to give it a current. The stones are to be of a uniform size, and not less than two inches thick, and to project two inches over the wall.

The smith is to make and fix a fancy cast-iron railing on the terrace, 3 feet 6 inches high, and fancy lamp-irons on ditto, and to make what wrought iron may be necessary for the railing, lamp irons, &c. and to make two strong wrought-iron grates for the drain.

Report of the Select Committee of the House of Commons, appointed to inquire into the state of the law and its consequences respecting the Exportation of Tools and Machinery. (Concluded from p. 345.)

Supposing, indeed, that the same machinery which is used in England could be obtained on the Continent, it is the opinion of some of the most intelligent of the witnesses that the want of arrangement in foreign manufactories, of division of labour in their work, of skill and perseverance in their workmen, and of enterprize in the masters, together with the comparatively low estimation in which the master manufacturers are held on the Continent, and with the comparative want of capital, and of many other advantageous circumstances detailed in the evidence, would prevent foreigners from interfering in any great degree by competition with our principal manufacturers; on which subject the Committee submit the following evidence as worthy the attention of the House, (viz. Mr. Galloway's):

" I would ask whether, upon the whole, you consider " any danger likely to arise to our manufactures from com- " petition, even if the French were supplied with ma- " chinery equally good and cheap as our own?—They will " always be behind us until their general habits approxi- " mate to ours; and they must be behind us for many " reasons that I have before given.

" Why must they be behind us?—One other reason is, " that a cotton manufacturer who left Manchester seven " years ago, would be driven out of the market by the " men who are now living in it, provided his knowledge " had not kept pace with those who have been during that " time constantly profiting by the progressive improve- " ments that have taken place in that period; this pro- " gressive knowledge and experience is our great power " and advantage."

It should also be observed, that the constant, nay almost daily, improvements which take place in our machinery itself, as well as in the mode of its application, require that all those means and advantages alluded to above, should be in constant operation; and that, in the opinion of several of the witnesses, although Europe were possessed of every tool now used in the United Kingdom, along with the assistance of English artisans, which she may have in any number, yet from the natural and acquired advantages possessed by this country, the manufacturers of the United Kingdom would for ages continue to retain the superiority they now enjoy. It is indeed the opinion of many, that if the exportation of machinery were permitted, the exportation would often consist of those tools and machines which, although already superseded by new inventions, still continue to be employed from want of opportunity to get rid of them, to the detriment, in many instances, of the trade and manufactures of the country; and it is matter worthy of consideration, and fully borne out by the evidence, that by such increased foreign demand for machinery the ingenuity and skill of our workmen would have greater scope, and that, important as the improvements in machinery have lately been, they might, under such circumstances, be fairly expected to increase to a degree beyond all precedent.

The uniform policy of the legislature of this country has been to give, as they conceived it, every kind of encouragement to British manufactures, by prohibiting the importation of foreign manufactures, and by giving premiums, bounties, and drawbacks on the exportation of British manufactures; but the great and important manufacture of machinery, tools, and utensils, has been made an exception to this system of legislation by restricting its exportation, although it is a manufacture peculiarly adapted to the circumstances of this country, and one that affords as many advantages in the way of giving employment to the people, and yielding profit to the master manufacturers, as any other manufacture.

The many important facilities for the construction of machines, and the manufacturing of commodities which we possess, are enjoyed by no other country, nor is it likely that any country can enjoy them to an equal extent for an indefinite period. It is admitted by every one that our skill is unrivalled; the industry and power of our people unequalled; their ingenuity, as displayed in the continual improvement of machinery and production of commodities, without parallel, and apparently without limit. The freedom which, under our Government, every man has to use his capital, his labour, and his talents, in the manner most conducive to his interests, are inestimable advantages; canals are cut, and railroads constructed, by the voluntary association of persons whose local knowledge enables them to place them in the most desirable situations; and these great advantages cannot exist under less free governments. These circumstances, when taken together, give such a decided superiority to our people, that no injurious rivalry either in the construction of machinery, or the manufacture of commodities, can reasonably be anticipated.

Your Committee, before they conclude, think it proper to remark, that by the act of last Session permitting artizans to emigrate and reside abroad, the country, as regards machine-making, is placed in a different situation from that in which it formerly was; and, from the evidence taken before the Committee, both in the last and present Session, in regard to the ease with which all plans, models, and drawings of new inventions in machinery are conveyed to the Continent, and the facility with which some engineers assert that good workmen can construct machinery from them, it is probable that if the present prohibitory policy is persisted in, foreign nations will be obliged to establish manufactories, (as has been already partly done in France, the United States, &c.) for those articles with which we refuse to furnish them, and which a liberal course of policy would entirely prevent.

The Committee deem it proper to submit an extract on this subject from the evidence of Mr. Henry Maudslay, an eminent engineer, as deserving the particular attention of the House:

"Can you state whether the manufactories for machinery " are increasing on the Continent?—Very greatly; I have " seen a number of them.

"Of what manufacture?—Of the manufactory of steam " engines and other machinery.

"What would be the effect of exporting machinery " upon the extension or diminution of the manufactories " on the Continent?—They would diminish them there is " no doubt; they would never set to work to furnish the " French manufacturers with French-English machinery if " they could get them from England.

"Do you consider the superiority of the English machinery " such as to secure a demand in the foreign " markets, if the laws permitted you to supply them?— " There is no doubt about it.

"Is it within your knowledge that the French are in " possession of drawings and plans of almost every patent " as soon as they are published in England?—Yes, I know " from circumstances that have come to my own knowledge. " On the first of every month, books are packed " off to Hamburgh, and sent through Holland and all parts " of the Continent, and a friend of mine has written to me " within a week of the publication, saying I understand " you have obtained a patent for so and so, and I hope it " will turn out to your advantage, and so on. This is a copy " of the French Repertory of Arts [*alluding to a book " produced by the witness*], and this is a drawing of a machine, " and is as good a plan as a man need to work from, " and I know this machine was not at work in our mint " when this book was published in France; I believe they " (Messrs. Bolton and Watt) had one in their manufactory; " but this shows the facility of getting these things in " France.

"Can a machine-maker work from that drawing?—Perfectly " well.

" You mean to say that any man that is able to make
" that machine can make it from that drawing?—Yes.

" Have you any other example of the same thing?—Here
" is a blowing machine, to smelt ore, and that is as good
" a blowing machine as any man need make; some of
" our first mills have that machine.

" Whose invention is that originally?—It is the inven-
" tion of Bolton and Watt, or some of the large iron-
" masters.

" Does your observation as to the facility of working
" from drawings apply to all sorts of machinery?—Yes;
" there is a set of drawings in the best Encyclopedias
" which will enable you to make a cotton machine.

" Is the drawing of that loco-motive machine [*alluding
" to an engraving in the book produced*] such as will enable
" a workman to make a similar machine?—Certainly;
" they make a great many thousand machines from much
" worse drawings, no doubt."

Although your Committee are impressed with the opinion that tools and machinery should be regulated on the same principles as other articles of manufacture, yet inasmuch as there exist objections in the mind of many of our manufacturers on this subject, which deserve the attention of the legislature; and as it is possible that circumstances may exist which may render a prohibition to export certain tools and machines used in some particular manufacture expedient, your Committee beg to recommend that, until an alteration can be made in the laws on this subject, His Majesty's Privy Council should continue to exercise their discretion in permitting the exportation of all such tools and machines now prohibited, as may appear to them not likely to be prejudicial to the trade or manufactures of the United Kingdom.

30*th June*, 1825.

On the Causes of the Hardening of Lime of various kinds.

By M. Hassenfratz.

Continued from page 388.

If we cannot attribute to the combination with the carbonic acid, solely, the hardening of the limes and mortars exposed to the action of the air, what can or ought to be the cause which, with the carbonic acid, contributes to their induration?

The pure carbonates of lime lose, on an average, 0·45 of their weight in calcination, and 0·10 of their bulk, when they are made into lime. These 0·45 consist of water and of carbonic acid; but it is difficult to determine the proportion of those two substances. Bergman, who only found 0·44 in his analysis, values the carbonic acid at 0·33, and the water at 0·11. But was his carbonic acid completely freed from water? We estimate the carbonic acid at 0·34, and the water at 0·10, in his analysis of 0·44. Wherefore, in order to regenerate, completely, one part of lime into carbonate of lime, it must be combined with 0·61 of carbonic acid, and with 0.18 of water.

For a long period the analysis of carbonate of lime made by Bergman was alone known; but since the end of the last century, a great many analyses of it have been made, with very great care. In these analyses all the chemists agree in having found in the carbonate of lime but an extremely small proportion of water. M. Thenard, in his comparative analysis of Iceland spar, which he considers as a very pure carbonate of lime, and in that of aragonite, found them to be composed of

Lime	0·563
Carbonic acid	0·433
Water	0·004

Thus, these calcareous crystals contain only 0·004 of water of crystallization, a quantity which appears very small. In the analysis of the coarse carbonates of lime which are used in building, and for making lime, there is found from 0·01 to 0·02 of water, and sometimes more when these stones are moist.

We have seen in slacking rich lime by the three different methods, that it is moistened in the first with four parts of water by weight; in the second, by immersion, that it requires at least 0·20 of water to become solid; and by the third, or spontaneous slacking, that its weight is increased 0·46. M. Vicat only found, in the first method of slacking, 3·6 of water combined with it; in the second but 0·18; and in the third only 0·40. We adopt here the results of M. Vicat's experiments.

Having reduced a kilogram of quick lime to a paste somewhat firm, after having slacked it by the three different methods, M. Vicat observed that the lime slacked by the first method became combined with 2·36 of water, and that its bulk was 3·1 of that of solid lime; by the second method the combined water was 1·31, and the bulk 1·04; and by the third method the combined water was 1·48, and the bulk 1·76. As the calcareous stone, which is fit to make very rich lime, loses 0·1 by calcination, it follows that, in order to be restored to the bulk which it had before calcination, it ought only to be increased 0·11 of the bulk which it has in the state of lime. Thus, to be brought back to the original bulk of the calcareous stone, it is requisite that the lime slacked by wetting should lose 0·64 of its bulk; that the lime slacked by immersion should increase 0·06; and that the lime slacked spontaneously should lose 0·37. The two portions of lime slacked by wetting and spontaneously, must then, as has been seen, be considerably diminished in bulk, while, on the contrary, the lime slacked by immersion ought to be increased.

It follows, moreover, from those experiments, that since there are limes whose bulk, after being made into paste, is less than that of the stone which has produced them, it is most probable that in becoming solid, and being regenerated, they would be increased in bulk.

Let us consider for a moment by itself, the lime mixed into a paste with water, what a contraction must take place in it to bring it back to its original volume; and how many chances of separation and cracks must it experience in drying and becoming solid? If the lime becomes regenerated, all the water must be evaporated, and be replaced by carbonic acid. As the proportion of carbonic acid ought to be 0·82 of the lime, it follows that 2·36 of water in the first method of slacking it, 1·31 in the second, and 1·40 in the third, ought to be replaced by 0·82 of carbonic acid. Besides, that the loss of the weight of the lime slacked by mixing it with water ought to be 1·54; for the lime slacked by immersion, 0·49; and for that slacked spontaneously, 0·58.

And if the exterior surface of the masses of lime should soon become hard in combining with the carbonic acid which it receives from the air, its volume could not be perceptibly diminished any farther; after which it is evident, that either the lime will remain in a paste in the interior of the mass, in preserving all the water which it absorbed, or that this water will evaporate through the regenerated coat. In the first case, the lime will always remain in its caustic and slacked state; and in the second, the inside will be filled with cracks and with vacuities, which will render the mass pulverulent, and will prevent it from acquiring solidity. If we suppose that the carbonic acid percolates into the mass, and regenerates the lime which it finds there, all the water will be evaporated, but the carbonic acid will only fill a part of the space; the mass will be porous, and full of vacuities. Finally, to prevent vacuities, it is necessary that only the quantity of water should be evaporated which would be replaced by the carbonic acid, and that the other part of it should remain; but in this case the volume of the water would be too considerable, and its layers, or films, too thick to perform the office of water of cohesion, and the mass would still have but little tenacity; from whence it will appear, that the best method of employing the lime, and that which will most favour its solidification, is to slack it into a dry powder, either by immersion or by spontaneous action. In fine, only to add to it the quantity of water necessary to make its volume 1·11 of that which the lime held before it was slacked; then the lime will become regenerated in acquiring the solidity and hardness which the stone possessed.

Few substances, perhaps, have as much affinity for water as lime; when it is pure, when it is entirely deprived of it, it seizes on it with great force; the lime becomes solid in uniting with it. To unite with its particles the water penetrates the mass, breaks the cohesion of the atoms of the lime to insinuate itself between them, and causes the lime to become pulverulent. This fact proves that the affinity of water for lime is greater than that of the particles of lime for one another, and that the force of the cohesion of the water to the lime is more considerable than that of the atoms of the lime to each other.

It is easy to conceive from this fact, that if the particles of lime were united by the water of crystallization, their force of cohesion would be greater than that of the particles to each other. All then that is necessary to obtain a very hard hydrate of lime, is to reunite the particles of lime to each other by very thin films of water, which may be effected by a slow and continued desiccation of the lime in a state of paste; but pure lime, when it has become a solid hydrate, has still a great affinity for water. If in this state it is exposed to the action of the air, it attracts the humidity which it contains; a division of this liquid between the air and the hydrate of lime then takes place, until the affinities of those two substances for water become in equilibrio. The hydrate of lime thus remains in a state of hardness, depending on the thickness of the films of water interposed between its particles.

This thickness diminishes in a dry air, and increases in a moist air, which causes the hardness of the hydrate to vary. To keep it in a constant state of hardness, it is necessary that the action of the lime on the water be diminished by that of some other substance combined with it, which effect carbonic acid produces in uniting to the lime; but every thing leads us to believe, if the analyses of the carbonates of lime are exact, that the carbonic acid drives off all the water of combination, and occupies its place.

We may then impute the hardening of the lime to two causes. 1st, To the action of water on the lime, which occasions a force of cohesion by so much more powerful as its quantity is smaller; or, more properly, as the thickness of the films of this liquid between the particles of the lime is less considerable. 2dly, To the combination of the carbonic acid first with the hydrate of lime, and then with the lime itself; a combination which not only diminishes the affinity of the lime for a new quantity of water, but which entirely displaces the water.

Every thing leads us to believe, that the substances which diminish the affinity of the water for the lime, such as magnesia, clay, the silicate of magnesia, &c. produce an effect analogous to that which water exercises on it; to which effect may be attributed the promptitude with which argillaceous limes set, such as the Roman cement of England, the plaster cement of Boulogne, and many other meagre limes; but every thing leads us to believe, that these same substances equally diminish the action of the carbonic acid on the lime.

The analyses of ancient mortars made by M. John, and which he has published in his *Memoir on Mortars*, which was crowned by the academy of Berlin, confirm our opinion, by proving that limes, in mortars exposed to the air, however ancient they are, do not always reabsorb the quantity of carbonic acid necessary to saturate them, and that they all contain water in smaller or greater quantities, which quantities are, with some few exceptions, in an inverse ratio of those of the carbonic acid absorbed, and in the direct ratio of those of the other combined earths.

We shall here give some of the analyses made of mortars exposed to the air.

SPECIES OF MORTARS.	Lime in the state of carbonates.	Lime combined with other substances.	Carbonic acid.	Combined silex.	Alumen and iron oxide.	Water.	Sand or cement, mixed with one part of lime.
Mortar of 100 years old, from the church of St. Peter at Berlin, at the outside joints	0·400	0·085	0·300	0·050		0·165	4·000
Mortar of 100 years old, from the inside joints of the same church	0·393	0·207	0·288	0·060		0·042	4·000
Mortar of 600 years, from a covered foundation of the same church, very hard and very tenacious	0·121	0·309	0·081	0·174		0·315	3·180
Mortar of 600 years, from the walls of the Cathedral at Brandenburgh	0·408	0·127	0·307	0·077		0·080	2·910
Roman mortar, from a wall of the city, built at Cologne, under Agrippa, in the 1st age of the Christian Æra	0·383	0·103	0·289	0·008	0·008	0·129	2·249
Roman mortar, from a tower constructed by Agrippa	0·361	0·180	0·272	0·015	0·067	0·105	1·273

It may be seen in these analyses, that one of the mortars which had lasted for six hundred years, and which was very hard and very tenacious, held 0·315 of water; that it had only absorbed 0·081 of carbonic acid; that out of 0·430 of pure lime, only 0·121 had been reconverted into carbonate, and that 0·309 had remained in the state of hydrate of lime. We may then attribute the extreme hardness of this mortar to the water combined with the lime, and interposed between its particles, consequently to the water of cohesion. We may likewise perceive that some of these mortars had absorbed a considerable quantity of carbonic acid, since it amounted in them to 0·307, and that others had absorbed the very small quantity of 0·081. Finally, that the mortar which had absorbed the least of the carbonic acid, or 0·181, contained the largest quantity of foreign matter, or 0·174, while that which had absorbed 0·300 of carbonic acid contained the least foreign matter, or 0·050, that is to say, about $\frac{1}{7}$ of the first lime.

Perhaps the more speedy setting of rich limes, which have slacked spontaneously, or of those which contain foreign substances, may in many cases be attributed to the same causes which determine the setting of mortars, and that we may consider limes of this kind as mortars formed naturally. In fact, lime slacked spontaneously, and which has been exposed a year or more to the action of the air, is a hydrate of lime mixed with a quantity, more or less great, of regenerated calcareous stone. It is then a mortar, in some degree analogous to that which is formed of slacked lime, and of chalk, stone dust, or marble powder. These limes ought to become hard more easily as the proportion of the lime to the carbonate of lime is most suitable. A question will arise with regard to mortars of this sort, whether the lime will not have sufficient action on the carbonate of lime to deprive it of a portion of its carbonic acid, and thus favour its induration and regeneration? We will leave this question to the determination of those engineers who are occupied with limes, mortars, and cements.

Of the setting or hardening of Lime in Water.

We have seen that pure limes had a strong affinity for water; that they solidified it and formed in this manner dry hydrates of lime; and that afterwards the water had a great affinity for those hydrates of lime, dissolved them, and made them pass to the liquid state.

Every lime whose hydrate will be in a state to be attacked by water, and be dissolved by it, cannot be employed in water, since this liquid will dissolve it in saturating itself with it. If the quantity of water in which the hydrate of lime is plunged be limited, the solution is continued until all the water is saturated; during this time the surface of the water exposed to the action of the air will attract carbonic acid; the dissolved lime will seize on it in abandoning its water of solution; a layer of the carbonate of lime will form on the surface, and afterwards fall to the bottom; the freed water will dissolve more lime, and the solution will thus continue until all the lime is dissolved and converted into the carbonate of lime. If the volume of water is infinite, as that of the sea, or if it is incessantly renewed, as in a current of water, a stream, or a river, the hydrate of lime will be continually attacked by the water in contact with it, and will be dissolved until the entire mass disappears.

Thus, the first thing necessary in employing limes in water, is to render their hydrates less soluble in water; or otherwise to give the limes a property by which they will have sufficient action on the water to form hydrates, and the water shall not have action enough on the hydrates to dissolve them.

This result will be obtained by combining pure lime with magnesia, with clays, with the silicates of magnesia, and finally with the earthy and metallic mixtures, which diminish or destroy the dissolving action of the water on the lime.

It is necessary to obtain this result, that the substances which are mixed and burned or baked with the lime should have an affinity with this earth, and that they should be themselves insoluble in water, such as magnesia, clay, more or less earthy, silex, the silicates of magnesia, &c. Every thing leads to the belief, that alumen (or clay), although insoluble in water, will not make the hydrate of lime equally insoluble, because that probably it does not combine with it intimately. Thus silex, when it is combined with lime, contributes to render its hydrates insoluble, whilst, when it is only mixed with it, none of its natural properties are changed.

The more the *alyudors* (that is to say, the substances which have the property of rendering the hydrates of lime insoluble in water) are combined in large proportions with pure lime, the more its hydrates are insoluble; and as the proportion of *alyudor* is smaller, their insolubility is less; nevertheless, in order to obtain a good lime, certain limits must not be passed, which are those where the proportion is such that it has no more action on water, or can be no longer slacked and form hydrates.

We have seen that the over calcination of rich limes give to their hydrates the property of being no longer soluble in water, as if they had been combined with magnesia or clay, &c.; does this arise from a portion of the lime having lost the property of uniting and combining with water, or from its having lost by the over calcination a part of its action on the water? Or finally, because in the common calcination there still remains a little water combined with the lime, which favours the union with more water, and that in the over calcination either all the water is carried off, or that part of it which was necessary to its slacking, and the formation of the hydrate? We will here only remark that this result is analogous to that of the union of water with clay. While the desiccation of the clay is not carried far enough, this silicate can receive new water, and be kneaded; but when the desiccation is carried too far by the action of the fire, then it can no longer unite intimately enough with water to be tempered and acquire the pastey state. It remains hard, and in order to restore its first properties relative to water, it must undergo certain operations. The same takes place with pure limes combined with magnesia, clay, &c.; they have need, to acquire all the action which is necessary for them, to undergo a calcination capable of driving off the carbonic acid and the water which they contain, that they may combine intimately with the earths; but, relative to the nature and the proportions of the component parts, they ought to undergo a particular degree of calcination; since, if too much calcined, they will become without effect, like dead lime; it is then said that they are vitrified. When nearly approaching to this degree of calcination they cannot be slacked in water, nor do they slack in the air; but being pulverized, they soften like gypsum and set pretty quickly.

Now that we know that one of the chief qualities of lime destined to set in water should be to have no more affinity to water left in it than what is necessary to form hydrates, it is easy to explain their hardening in water by the film of water interposed between their particles; that film of water whose two surfaces ought to have an equal effect on the adjoining particles of lime; that film of water which may be diminished, because the particles of lime come sufficiently near for their mutual affinity to commence its action; then the force of cohesion is composed first of that of the particles for the film of water, and next of that of the particles of lime for each other; a force of cohesion which increases continually in proportion as the particles approach each other.

From these principles it is easy to conclude, that the pastey and firm masses of lime, whose hydrates are not dissolved by water, being placed beneath water, experience continually a pressure of that fluid on all its surfaces; that this continual pressure tends to bring the particles of the hydrates close to one another, to cause the superfluous water to pass off, to diminish the thickness of the films of water, and to increase continually the force of cohesion, from whence the hardness of the lime arises.

If this water contains carbonic acid gas in solution, this gas may approach the surface of the mass of lime, and regenerate calcareous stone, which will place these limes in a situation analogous to that which takes place in the air; but being placed in a situation more favourable, they will be, besides exposed to a pressure, constantly exerted, which will tend to draw together the particles of lime, and to diminish the thickness of the films of water which separate them.

We have, besides, in the three analyses which M. John made of hydraulic mortars, that is to say, of mortars or cements plunged in water, proofs of this double action of the films of water, and of the carbonic acid in the hardening of these sorts of mortars.

KINDS OF MORTAR.	Lime in the state of carbonate.	Lime combined with other substances.	Carbonic acid.	Combined silex.	Alumen and oxide of iron.	Water.	Sand or cement, mixed with a part of the lime.
Mortar, 300 years old, from the inclosure of the Castle of Berlin..........	0·032	0·186	0·022	0·088		0·722	8·445
Ancient Roman hydraulic mortar......	0·281	0·876	9·214	0·0'3		0·127	8·514
Mortar of Treves, 4 years old.........	0·044	0·447	3·083	0·119		0·347	

Among these mortars there is one which had only 0·32 of lime regenerated, and which retained 0·722 of water. Nevertheless, this mortar was 300 years old.

We may conclude from all this, that the setting or solidification of the lime in a mass is occasioned by two causes: 1st, by the action and by the adhesion of the water to the particles of the lime, an action and adhesion which causes a hardness by so much more great, as the film of water which separates these particles is thinner: 2dly, by the combination of a substance, the *alyudor*, which destroys the dissolving action of the water on the hydrate of lime. This substance, when the limes are exposed to the action of the air, is, in a great number of cases, the carbonic acid; and when they are placed beneath water, one or several earths, united sometimes to metallic oxides. In some cases these two actions, that of the carbonic acid and of the earths, act together. When the carbonic acid acts by itself, it drives off the combined water and occupies its place. When the carbonic acid acts in conjunction with different earths, it is probable that its action is not so great, and that all the water is not displaced by it, as may be seen in the experiments of M. John.

This lime, which remains free, which we consider as being solidified by the water of cohesion, M. John considers, on the contrary, as being combined with the other earthy matters, and as forming a substance analogous to feldspath; it is this combination which he regards as the true *cement*, and which we call *alyudor*. Builders and men of science will decide between this opinion and that which we have given.

On the colouring matter of Coffee. From *Revue Encyclopédique.*

On repeating the fine experiments of Brugnatelli on the colouring matter of coffee, M. Bizio, of Venice, observed, that when a drop of infusion or decoction of the berry fell upon cloth, it formed a yellow stain, surrounded by a border of a fine green colour, which he attributed to the oxydizement of the oil contained in the berries. To fix this colour, he boiled a hectogramme (nearly two pounds and a quarter) of coffee in powder, and reduced the decoction to eight hectogrammes. To this he added an equal quantity of sulphate of copper, dissolved in water, and employed as a precipitant a solution of caustic soda. The deposit which formed weighed 105 grammes (= 1622 grains), and on drying it in the air he saw it acquire a green colour, which was so much the more brilliant as the substance was more moist at the moment of its exposure to the free air. M. Bizio has proved, by many experiments, that neither water, ether, alcohol, nor the alkaline subcarbonates, have any effect on this colour. Caustic potash turns it sky blue. Soda does not alter it at all; and no acid, with the exception of the sulphuric and oxalic, destroys the colour entirely. By dissolving his substance in acetic acid a green tint is obtained, the beauty of which is still greater.

NOTICES OF NEW PATENTS.

Patent granted to WILLIAM LEAHY, *of Great Guildford-street, Southwark, engineer, for improvements in the machinery or apparatus for making bricks, and for certain improvements in the drying of bricks by means of flues and steam.* Dated 11th Nov. 1824.

MR. LEAHY'S apparatus for making bricks may be divided into four principal parts; 1st, That in which the clay or brick-earth is worked up and pressed forward; 2d, That which receives it from the first part and presses it into the moulds; 3d, A large vertical wheel that contains the moulds on its edge, receives the clay into them, and by machinery inside forces it out again, after being moulded upon boards that are passed beneath its lower edge; and 4th, Endless chain bands that carry forward these receiving boards from the rest of the apparatus, and which receive their motion from two polygonal wheels round which they are passed, placed with their axles in a horizontal plane, and parallel to each other, beneath the moulding wheel.

The first of these divisions consists of a conical vessel of cast iron, with a vertical shaft turning round in its centre, from which flat knives or cutters project at right angles in several parts, so as to pass near other cutters that project from the sides of the conical vessel horizontally towards the centre, which part of the apparatus is in common use in the potteries, and also for making mortar in many places,; in continuation of this vertical axle, a second one is placed so as to turn independent of it, on which, at the bottom of the conical vessel, is fixed a helical plate, forming a portion of a flat screw by which the clay is driven downwards with considerable force, after being well worked by the cutters in the upper part of the vessel, which cutters turn round fifteen times in a minute, while the spiral plate only makes five revolutions in the same time, and those in the contrary direction from that of the cutters.

The second division, into which the clay is forced from the first, is a sort of box, whose sides are segments of circles, to which the two sides of the moulding-wheel apply closely in front for the greatest part of their extent; the rest of its face next the wheel that is not closed by it, being cased up so as to join the bottom of the conical vessel; a portion of the back part is also in a similar manner cased up to this vessel, but its lower part is occupied by a moveable diaphragm or shutter, which is jointed below in front next the moulding-wheel, and whose upper part works back and forwards between the sides to and from the wheel alternately, which motion it receives from a rod moved by a crank, that is turned round by the general machinery that gives the required motion to the other moving parts; this diaphragm presses the clay into the moulds at the edge of the wheel, as they pass by it in succession; and to prevent the clay from passing out behind it, when it is pressed towards the wheel, a segment of a hollow cylinder, or cylindrical plate, is placed at its top, which, fitting close to the back of the box above it, prevents any thing from passing out in that direction.

The third division, comprising the moulding wheel, is the most complicated; round its edge as many moulds are placed as its circumference will permit, separated from each other by triangular or wedge-shaped pieces, with their edges turned to the centre; in each of these moulds a square piston, that fits it exactly, is moved once up and down in each revolution of the wheel, by a rod that passes from it towards the centre of the latter; the upper part of each of these rods is turned outwards at right angles from the side of the wheel, at which portion of it two rings are attached that are concentric with it, and one being larger than the other, are placed at such a distance asunder as is required for the motion of the said rods to and from the centre of the wheel, they acting as stops to the rods for confining their ends within the required limits; to move these rods and pistons from the centre towards the clay-box and compresser, a smaller wheel is fixed close by the side of the large wheel a little below its centre, in whose edge are formed cavities that, as it turns round, receive in succession the bent arms at the top of the rods; and moving in the same direction as the large wheel, must of course give them motion in the direction required, whose speed and degree will be regulated by the relative velocity of the two wheels in their revolutions; the other motion necessary for these pistons, from the circumference towards the centre, is given in a simple manner by a piece shaped like a long curved wedge with the point upwards, fixed near the side of the large wheel in the frame-work, so as to lie with its point near the outer ring above mentioned, and its base near the inner ring, in which position it must act on the bent arms of the pistons, as they pass by it, so as to draw them from the outer ring to the inner one, or towards the centre. A flat scraper that passes along the bottom of the clay-box towards the edge of the wheel, completes the junction of this last division of the apparatus with that before described; its use is to confine the clay at the bottom of the box, and scrape back into it from the bottom of the moulds whatever part is superfluous, and also to shape it smoothly at that part of the moulds; it is pressed towards the wheel by a strong spring at each side of, and is supported by a pair of rollers to facilitate its motion.

To the description of the fourth division of the apparatus already given, nothing need be added but that the polygonal wheels, which carry the endless chains, or chain bands, are placed in the plane of the moulding wheel, and convey the boards which receive the moulded clay, or raw bricks, to some distance from the whole apparatus, where they are taken off by hand and conveyed to the drying-house.

The moulding wheel has been described as making only a single row of raw bricks at once; but it is plain that two or more rows of them may be formed at the same time in the manner mentioned, by proportionably increasing the number of the moulds, and of the pistons, and other parts connected with them.

The machinery, or mill work, which gives each of the moving parts of the apparatus its proper motion, is all connected with one first mover, and may be impelled by any power most convenient; it consists of a bevelled tooth-wheel attached to the moulding-wheel, and of the same diameter, and of other similar wheels of sizes proportionate to the effects intended for them, connected with the other wheels and axles described, by shafts and pinions placed in suitable positions; but for a more particular description of the exact size of each wheel, of its number of teeth, and of the precise measurement and position of each part, reference must be had to the figures of them in the drawings that accompany the specification at the enrolment office, without which any attempt at conveying a farther idea of them would not be very intelligible.

The improvements in drying bricks mentioned in the title, refer to two methods for the purpose, the first of which is to place them sufficiently apart from each other, on shelves, in a drying-house properly constructed, which house is heated by hot air passing in flues either of brick or iron beneath the raw bricks. In the second method horizontal steam pipes are used, at a certain distance from which other pipes are placed parallel to them, for conveying back the condensed water to the boiler, and between the two sets of pipes, others pass at certain intervals at right angles to them, in groups of 5 or 6 together pretty close to each other, over which groups of hot pipes stages are fixed, on which the raw bricks are arranged for drying, as on the shelves; proper spaces are left between the stages for passages, and the chain bands that convey the raw bricks from the apparatus for moulding them, are described as bringing them close to the drying-house. The steam boiler for supplying the pipes, it is stated, may be either outside the drying-house or within it, as is judged most convenient; and after the bricks are sufficiently dried, they are to be burned in clamps or kilns, whichever is preferred.

The patentee expects great advantages from this mode of drying bricks in wet seasons, and from the facility it affords of making them in winter.

More than twenty years since Mr. Hudson, an American, obtained a patent for machinery for making bricks, which contained the conical vessel, cutters, and revolving spiral plate, of this apparatus. Many persons in the vicinity of Somers' Town, near which one of them was put up, may remember seeing it at work. It had not the moulding wheel, or the other parts already described, whose place was supplied in a simpler manner. Mr. Leahy's more complicated machinery would seem more effectual and complete for the purpose, particularly if it receives the very necessary addition of a contrivance for sanding the moulds on the moulding wheel, without which no perfect bricks could be formed by them; and no directions whatever are given on this essential matter in the specification.

The system of brick-making, much as it is practised, appears to be very imperfectly understood. Nothing can be more variable than the consistence of those brought to market here; some of the yellow-grey stocks (which come from the country) are as hard and firm as Portland stone, while other sorts are so friable as to be broken to pieces by very slight blows. It seems from this and other circumstances, that little care is taken in selecting materials for them; and that it is in general the convenience of having them in a certain place that causes them to be made there, and not the fitness of the earth found in that place for the purpose, which ought to be a primary consideration. The defects of common bricks seem mostly to arise from a want of clay (alumen or argil) in their composition, and from the mode of burning, or rather baking them, not being sufficiently perfect. Some cart loads of the coarse clay found near the river below London, and in other parts, added to the earth used for each clamp of bricks, together with such other additions as might be pointed out by a more exact examination of that earth, by any of the rough methods of analysis now so generally known, would probably be a useful and profitable remedy for the first cause of these defects; and for the means of obviating the second cause, some useful hints will be found in our last number.

Patent granted to SIMON BROADMEADOW, *of Abergavenny, Engineer, for a method of manufacturing and purifying inflammable gases by a mixture of atmospheric air.* Dated January 19, 1824.

IN the apparatus which is described in the specification of this patent, and in the accompanying drawing of it, intended to exemplify the methods used by the patentee for the purposes stated in the title, two gas ovens or retorts, seven feet long and five feet broad, are constructed, with fire-places beneath them, both furnished with doors or stoppers, of the usual construction. From these retorts pipes ascend to small vessels, 10 or 12 inches high, designed to condense the tar, from which other smaller tubes descend downwards back again into the retorts, to reconvey to them the condensed tar. One long horizontal tube, of 4 inches diameter, communicating with these two tar vessels, passes on from above the retort furnaces a few feet, and then bends downwards into a larger vessel, called the gas condenser, on the top of which is placed a pair of bellows, two feet long, and 16 inches wide, which communicates with it by a pipe that descends from the aperture of its valve or clapper. From the nossel of this bellows a pipe passes to the gas holder, and from its upper part a handle is shown in the draft, projecting some length from it, by which it is worked. In each door of the retorts is a hole, stopped with a plug, which, when the retorts are charged, and the fires are lighted beneath them, are to be opened as soon as the gas is produced; immediately after which the bellows are to be worked, which will draw the gas from the retorts through the gas condenser, and force it into the gas holder or gasometer. The patentee then directs, that when *eight* parts of gas are drawn off, the fires are to be put out, and the doors of the retorts are to be opened, and the bellows to be still continued at work, till a quantity of atmospheric air be drawn through the retorts and the open doors, equal to a ninth of the whole quantity. These directions are not quite distinct; but the meaning obviously is, that, when the charge ceases to produce gas, the doors of the retorts should be opened, &c. as mentioned, and air should be drawn through them, and forced into the gasometer, equal to an eighth of the gas which it before contained. This proportion of air the patentee asserts he has experienced to have the effect of purifying the gas; and that the plan altogether admits of the retorts being made much lighter and cheaper, from the pressure of the expanded gas being by it removed from them, and also that it will render unnecessary the accurate stopping or luting of the retorts before customary, and make chinks or leaks in them of less importance.

The patentee, in this process, only calculates on an eighth of air being mixed with the gas; but it is evident that a much larger portion than that must be introduced by the plug holes of the retorts, which are specially directed to be left open from the first working of the bellows.

When it is considered that a certain portion of atmospheric air, mixed with coal gas, will cause it to explode, the danger of this plan must be plain to every judgment, from there being no method suggested in the specification of regulating the portion of air which thus passes through the plug holes.

From a sixth to a twelfth of coal gas, mixed with air, will cause explosions, the mischief of which has been but too often experienced. We do not, however, assert that there will be much danger if the limits prescribed, in which the gas would be eight times as much as the air, were actually observed; yet as this is not provided for in the specification, the risk to which the plan of the patentee is liable is obvious; but we presume, in carrying the invention into practice, the patentee has remedied this defect of the specification.

Patent granted to GEORGE VAUGHAN, *of Sheffield, Engineer, for an improvement or improvements on steam-engines.* Dated May 1, 1824.

AN idea may be formed of Mr. Vaughan's steam-engine, by supposing the cylinder of a single steam-engine to be placed with its bottom upwards, and another similar cylinder to be fixed in the usual position directly upon it, so that the piston rods of both may be in the same vertical line. Each of these cylinders has its separate piston, and the two piston rods are connected together by two bars, which pass outside the cylinders, from the ends of a cross-piece on the extremity of one of the piston rods, to the ends of a similar cross-piece on the extremity of the other piston rod; the two pistons being previously so placed that one of them shall be near the open end of its cylinder, when the other is near the closed end of that in which it moves. A case is directed to be put over the two cylinders, to confine the heat, and the openings between this case and them at each end are to be closed, so as to exclude the air. A pipe, furnished with a cock, is to pass from the steam-pipe, near where it enters the valve box, to the inside of this case, to convey steam into the space between it and the cylinders when the cock is opened, to keep the cylinders hot; and from the lowest part of the case another pipe passes out, furnished also with a cock, to let off the water formed within the case by the condensation of the steam. The bars which connect the two piston-rods pass through tubes of copper or other metal, placed vertically between the case and the cylinders, and fastened at each extremity to the ends of the case so as to be air-tight.

The valve box is fixed at the junction of the two cylinders, and in it a sliding valve is used, having a cavity within it, which, as it is moved up and down, alternately forms a communication between the passages that lead to the two cylinders, and those which go to the steam-pipe and to the condenser, the rod which works this valve passing through a stuffing box at the top of the valve box. The beam of the engine is to be connected with the piston rods by the links of the parallel gear being joined to the upper cross-piece, that unites the piston rod to the vertical bars. The valve rod is to receive its motion from some of the working parts of the engine in the usual manner, and the boiler, and all other parts not particularly described, are also to be constructed as shall seem best to the engine maker. Nothing more being peculiar to this engine, except a pipe for conveying oil above the lower piston, which passes through the case and the lower cylinder near where it joins the upper one, and which is furnished with a cock, and a small upright tunnel at its outer end, to receive the oil.

The patentee mentions that the cylinders of this engine and the case may either be all cast together, or in separate pieces, to be afterwards united, and that the partition between the two cylinders, where they meet, may be cast with them, or be made separate and bolted in afterwards.

We apprehend this engine would be much more expensive than a double engine of the usual construction, from requiring twice the length of cylinder (which is the most costly part) to produce the same effect; and it would also, we believe, waste the heat considerably more, from the air entering into the cylinders alternately, as the pistons approached the juncture, and cooling them according as its temperature was below theirs. The hollow sliding valve, which is the best thing in the engine, appears to us precisely the same invention for which Mr. John Dickson obtained a patent in March, 1808, the specification of which was inserted in our 13th vol. second series, p. 159.

Patent granted to JOHN VALANCE, *of Brighton, Esq. for an improved method of carrying off caloric or fluidity from, and congealing, water; and it may be other liquids; also an improved method of producing intense cold; also methods of applying this invention so as to make it available (to purposes) with reference to which temperatures about freezing point may be productive of advantageous effects, whether medical, mechanical, or chemical.* Dated August 28, 1824.

MR. VALANCE, in the beginning of his specification, gives a history of the method of freezing water by the action of the air pump in accelerating evaporation, which concludes by notice of Mr. Nairne's discovery, that sulphuric acid would speedily absorb the vapour so produced, and of Professor Leslie's application of this discovery to produce a degree of cold sufficiently intense to consolidate mercury. By Mr. Leslie's method, only a small quantity (not more than a pound) of ice could be procured at once, as the process of freezing the water through the crust of ice at its surface was necessarily slow, from ice being a bad conductor of heat, and from its impeding the evaporation of the water. Mr. Valance's plan is intended to remove these defects, which he proposes to do by causing a current of highly rarefied air to pass over a surface of water, which is perpetually renewed by fresh additions in proportion as it freezes, in an apparatus on the same principles as Mr. Leslie's, but on a much larger scale, and in which the sulphuric acid is made to expose a very extended surface to the air holding the evaporated water.

The apparatus for this purpose, described by the patentee, consists of a large air pump, more than a foot in diameter, and about 8 inches high, to be worked by a suitable power, beneath which is placed a cylinder, which is connected to its bottom by flanches and screws. This cylinder is open at bottom to admit another cylinder, in which the ice is to be formed, and whose bottom projects beyond the first cylinder, and turns up 3 or 4 inches, so as to inclose it for that depth, and form a receptacle for mercury, to produce an air-tight joint between the two cylinders of a nature that will permit them to be separated with facility.

Through the middle of the bottom of this latter cylinder a metallic rod rises in an air-tight aperture, to near the bottom of the air-pump, and on the top of this rod is placed a flat circular dish, on which the water is made to fall in very minute streams from a pipe that conveys it from an exterior cistern, which pipe, at its end that is over the dish, is perforated with several extremely small holes for this purpose. Above this dish is the passage to the air pump, which terminates here in a low hollow cone, whose edges lie very near to the dish, and to which the latter may be approached or removed from it, by the rod which supports it being formed with a fine screw at its lower end, which passes through a nut in a stand beneath it, and having four handles projecting from it, just above the screw: it may by them be easily turned either way, so as to ascend or descend as required. From the top of the air pump a pipe passes to the bottom of a third vessel, in which the rarefied air is exposed to the action of the sulphuric acid, and from the top of this latter vessel another pipe descends, below the air pump, to the vessel in which the ice is formed; in consequence of which arrangement, and of the disposition of valves in the air pump, when this is worked the air is drawn through the vessel holding the sulphuric acid, and over the stratum of water on the plate in the ice vessel, and is passed round again to the first vessel; and thus circulates as long as the pump is worked, carrying off the vapour and combined heat from the water, and depositing them with the sulphuric acid; by which means a coat of ice is soon formed on the plate, and continually accumulates as the water falls on it, the rod that supports it being lowered gradually by the screw as this takes place, to leave space for it by making the plate descend.

The vessel for the sulphuric acid is an iron cylinder, with a conical bottom, having the point downwards, lined with lead, and about the same size as the ice vessel. In it a number of round flint stones are placed (which are easily found on the sea shore), to increase the surface on which the acid is to be spread; and at the top of the vessel is a revolving pipe, to spread the acid over the flints, bent in an angle, one arm of which ascends up through the middle of the top of the vessel, where it terminates in a funnel, and the other arm circulates over the flints, dropping the acid on them through very small perforations in its sides. To give it which motion, a horizontal wheel is connected with it by an axis above the funnel, which is acted on by a vertical wheel, that is turned by the machinery which works the pump, or by hand, as desired. The pipe and funnel may be made of lead; but, to give the joint sufficient stiffness where it passes through the top of the vessel, it should be inclosed in a platina tube, working in another of the same metal.

From the conical bottom of this vessel a small pipe is to descend several feet downwards, bent upwards at its lower end, to retain in all cases a portion of acid, which is placed in a small vessel, to hold the acid that runs down over the surface of the flints. The length of the pipe must depend on the degree to which the air is to be rarefied, since, if a perfect vacuum were to be formed, it must be more than 81 feet long to allow the acid to pass out freely. The acid may be raised from its receptacle to the funnel in various ways, but Mr. Valance prefers an Archimedes pump of lead for this purpose. To make the apparatus more perfect, thick glass lenses are cemented air-tight in the sides of the ice vessel, nearly on a level with the part where the ice is to be formed, through which lenses the state of accumulation of the ice may be seen, in order that the dish may be lowered accordingly. And in order that the ice may be compact and free from bubbles, the water is to be previously boiled, or in some other manner freed from air, before it is put into the cistern to be conveyed to the ice vessel; to regulate its flow into which, the pipe through which it passes has a cock attached to it near its lower extremity.

Mr. Valance describes two or three variations of the foregoing apparatus, in one of which, plates of glass, 3 feet long, and 4 or 5 inches broad, are substituted for the flints, as a medium for giving an expanded surface to the acid. These plates of glass are arranged upright between two hollow cylinders, with their planes in the lines of the radii, and the acid drops down on them from a revolving tube, similar to that before described. In another of the variations, in place of the single low conical termination to the tube that passes from the ice vessel to the air pump, over the dish on which the water falls, there are seven smaller ones, six of which form a circle round the seventh, each having a separate tube passing to the air pump, by which disposition it is supposed the passage of the rarefied air would be more rapid over the wet surface of the dish or ice beneath, than in the first method. In both ways Mr. Valance calculates that the velocity of the air in passing over would be very great, and that the rapidity with which it would carry off the caloric along with the vapourized water would be proportional.

In order to produce cold below the freezing point, Mr. V. directs that the flow of the water into the ice vessel be stopped for some time after the ice is formed, and only be admitted at intervals, by which means the rarefied air will act in vapourizing part of the ice itself, and thereby will reduce its temperature still lower. To an apparatus managed in this latter mode, he directs what may be called a cold closet to be attached, in which the various compositions designed for ices for table might be placed.

Of the useful purposes, mentioned in the title, to which Mr. V. proposes to apply this improved method of freezing, the mechanical are the most particular, the medical consisting merely in procuring iced drinks for fever patients in hot climates, and the chemical being barely noticed in general. The mechanical application consists in using the apparatus as a refrigerator, for an engine of similar construction to a steam-engine, but in which the expansion of ether by heat, and its contraction by cold, is to produce the power instead of steam; and Mr. V. states, that as sulphuric ether boils at 98°, and muriatic ether at a much lower temperature, that a small addition of heat would cause the piston of the engine in which they were used, to raise 80lbs. on each square inch of its area. The objection to this plan would be, the great expence of the ether, particularly of the muriatic ether; but Mr. Valance thinks that it is most probable that the whole of it would be recovered by the use of his freezing apparatus, so as to serve repeatedly in the engine, without any material loss, particularly if no chemical change was produced in it by the operation; and though sensible of the uncertainty that must attend untried projects of this nature, and of the objections to it, he concludes by giving his opinion that ether might be applied profitably in this way as a mechanical impeller.

The most material circumstances in Mr. Valance's very voluminous specification (which covers twelve skins of parchment) have been here recited; but of course there are some particulars of less consequence which we have omitted for the sake of brevity, such as the mode of rarefying the air that was to circulate in the apparatus; another variation of the latter, in which the external air was admitted occasionally, and the air that had been operated on given out; and a method of forming the valves of the air pump by oiled silk fastened round rings of wire.

It is easy to perceive that from the expensive nature of the apparatus, that it could never come into competition with the mode of freezing by ice preserved in ice houses so as to afford profit; and even in hot climates, where ice is not formed naturally, it would sometimes have to contend with methods which the natives practise to form it artificially, of some of which an account may be seen in the Annual Register, as they are practised at Calcutta, Allahabad, and other places in the East Indies. Besides, the apparatus described by the patentee could not act long, on account of the corrosion which must take place in all its working parts where lead could not be applied, from the air taking up a portion of the sulphuric acid, and conveying it into the air pump and most other parts; and to line the whole of the working parts with platina, especially when made on the large scale proposed, would produce an expence that few would choose to encounter for an object of so little apparent benefit; but in thinking it to be so we of course differ widely from the patentee, who has thought it worth the cost of two patents, the present being the second which he has taken out for his methods of producing cold. Indeed, we might venture to predict, that no profit can ever arise from the mode of freezing by sulphuric acid, however improved or modified; and that if any of the plans mentioned by the patentee should come into use, it would be that in which a current of air, passed over ice, was made to reduce the temperature of his cold closet, but with the condition of omitting the sulphuric acid altogether.

If, indeed, water could be frozen without the use of acids or other expensive mediums (which would at least require coals, labour, and chemical skill to prepare them for use, repeatedly), the means which it would afford of procuring fresh water at sea would alone make it of the greatest consequence; but the methods of freezing proposed in this specification are neither applicable to this purpose, nor do they afford any clue which might lead to it, though we have still reason to hope for its attainment from other processes of which we have some intimation, and which have not yet been made public.

Of the utility of the mechanical application of ether as a power for giving motion, we have still less expectations; for, exclusive of the objections to its cost, and the very great improbability of the apparatus of the patentee condensing it completely, when once rarefied, the nature of its composition and the action of the metal of the apparatus on the acids which necessarily enter into it, would soon so far decompose it, and alter its nature, as to destroy those qualities which would make it valuable for the use proposed.

Patent granted to William Henry James, *of Coburg Place, Winson Green, near Birmingham, Engineer, for an improved mode of constructing steam-carriages for highways.* Dated May 15, 1824.

The steam-carriages described in this specification are intended solely for common roads. Instead of the former method, of using one steam cylinder, or at most two, for each steam-carriage, the patentee directs that a steam cylinder shall be used for *each* wheel, and in his draft, in fact, two cylinders are represented at each extremity of the two axles, so that eight steam cylinders will be required altogether for this plan.

These cylinders the patentee states are to be very small, but does not mention their precise dimensions; and as the pistons of each pair of them are arranged to operate so on the cranks with which they are connected, that when one is vertical the other will be at right angles to it, to save the use of fly wheels, every pair may be considered as one engine acting on the wheel which it is intended to move. These cylinders are placed beneath the axles of the carriage, and the cranks are fixed above them, and each of these cranks is furnished with a spur wheel, which, by another wheel of the same sort, acts on a toothed ring, attached to the nave of the carriage wheel, which nave turns freely on its axle. From these cylinders pipes run to the steam boiler, on which cocks are so placed that, by turning them in certain directions, the steam may be let on or shut off from each pair of cylinders as required, and also may be admitted partially sometimes; by which means each wheel can have its degree of velocity regulated in respect to that of the others, as may be best suited for making the carriage turn round a corner, or move in any curve desired.

The steam boiler is placed beneath the perch, near the hind wheels, and the chimney still further back, together with the seat of the engine-man, who not only keeps up the fire, but, by handles placed near him, which communicate with the cocks before-mentioned, can stop either of the hind wheels or diminish their motion, as may be most suitable to the slope of the hills, in descending which locking of the wheels might be necessary. The engines used with these carriages are to be of the high pressure species, so that the steam might be discharged from the cylinders at once after being used; but to obviate the inconveniences which this would cause, pipes pass from them to the chimney, to carry off the waste steam along with the smoke.

The front axletree is made to turn on its centre as usual, and the steam pipes on it have joints at the centre of motion, similar to those of cocks, to admit of their being turned along with it; a segment of a horizontal toothed wheel is attached to this axle, in which a pinion works, from which a vertical shaft ascends to the seat of the director, which is placed directly above it, and is constructed like a coach-box. On the top of this shaft a horizontal wheel, furnished with handles like the steering wheel of a ship, is fixed, by which the director can turn the front axletree as the curvature of the road may require. Horizontal rods are also so arranged between this axle and the cocks, that in proportion as it is turned the steam may be shut off from the cylinders at the side next the centre or centres of the curvature of the road, by which means the wheels at that side move more slowly than the others. Besides the steering wheel, there are two levers with handles, placed near the seat of the conductor, which communicate by cranks with the rods just mentioned, by which the cocks are turned, and by moving which he can either diminish the motion of the wheels at one side, as he pleases, or stop off the steam from all the cylinders at once, when it is required to stop the progress of the carriage.

Two bodies of coaches are represented in the drawing, placed above the axles in the usual position for double-bodied carriages; and both their arrangement, and that of the parts of the steam-engine not particularly described, is directed to be such as is commonly used in similar cases. The specification concludes, after this, with the usual clauses relative to variations of parts, and the particularisation of the claims of the patentee.

With respect to this plan of Mr. James's, a question arises whether the multiplication of cylinders, which it directs, may not add more to the weight by their number, than what their small size may admit of its being diminished in each of them, from the greater strength which this reduction of size causes in proportion to their substance. There should also be taken into this account, that the weight of many wheels and of some heavy shafts are saved by this plan, which are necessary in those others for the same purpose lately made public, as may be more clearly seen by comparing it with that of Messrs. Burstall and Hill, given in our third Number.

Mr. James has on this occasion fallen into the same error as Messrs. Burstall and Hill, in placing the seats for the passengers, and the receptacles for the luggage, &c.

on the same wheels with the steam-carriage, by which accumulation of weights a degree of pressure must be caused on the wheels, so great that no common road could bear it without speedy destruction.

As this is a very important point of consideration with respect to steam-carriages, we beg leave to refer to the observations which we have already made respecting it, at the conclusion of the account of the patent of Messrs. Burstall and Hill.

Patent granted to JACOB PERKINS, *of Fleet-street, London, Engineer, for certain improvements in propelling vessels.* Dated August 9, 1824.

IN Mr. Perkins's method of impelling vessels, flat paddles or impellers, like the blades of oars, are made to revolve behind the stern of the vessel in a plane, at right angles to the keel; and, from being sloped so as to form *inclined planes* to the line of impulse, they tend to move the vessel in the opposite direction to that in which their faces act on the water. To prevent the oblique impulse from turning round the vessel, two sets of these paddles are made to move in opposite directions at the same time, and are of course attached to separate axles, which, to prevent any projection of the paddles beyond the sides of the vessel, are made to revolve concentrically by one of them being hollow, and the other passing through and turning round within it.

On each of these axles Mr. P. only employs two paddles, opposite to one another, whose slopes or inclined planes are so curved, that close to the axle they form an angle of 45° with it, while at their extremities the angle of inclination is 22½.

One end of the solid axle, on which the other is sustained, lies inside the stern, and its other end is supported by a cross piece that rests on the ends of two long levers, which run along the sides of the vessel, and turn on pivots, placed exactly in a line with the inner extremity of the solid axle; which axle is supported by a cylindrical piece of metal, capable of moving in its socket or bed, so as to admit of the outer end of the axle being raised or lowered by the motion of the levers and cross bar; by which operation the depth to which the paddles shall descend into the water is regulated.

To receive the requisite motion from the steam-engine, or other moving power, the solid and the hollow shaft have each a mitre wheel at their inner extremities, near the cylindrical piece by which the former is supported, and through which it passes a few inches, to allow of the mitre wheel at its end being at the same distance from the cylindrical piece as the wheel on the hollow axle is at the opposite side. Two other mitre wheels are placed at right angles to those, with their teeth mutually interlocking, but turning freely on their axles, the ends of which move in the cylindrical piece that sustains the solid axle of the paddles. On the same axle with these two latter mitre wheels, two spur wheels are fixed, which connect the axles with the moving power, and which, while they turn round with those axles, are capable of being moved sideways to or from the last-mentioned mitre wheels, so as to be united or separated from them as required, by projecting pieces attached to them for that purpose, in the manner common in mills for similar effects. A metal frame passes outside those spur wheels, and moves in grooves in the bosses which connect them with the axles, so that when it is drawn to one side, by a screw placed there for that use, and turned by a winch, the mitre wheel at the opposite side is joined to the moving machinery, and the other one turns loosely in the axle; and when the screw is turned the other way, the mitre wheel that was before loose comes into action, and that formerly in action becomes loose; by which means the direction of the motion of the paddles may be quickly reversed, and the vessel made to go back or forward as required.

Mathematicians have long been in favour of impelling vessels by inclined planes, and in 1752 Daniel Bernouilli obtained a premium from the Academy of Sciences at Paris, for a method of doing this by *rotary inclined planes*, accounts of which, and of some others, may be seen in the Retrospect of Philosophical Inventions, &c. vol. i. p. 248. We are inclined, however, to give the preference to Mr Perkins's plan, from its superior practical arrangements; but feel somewhat apprehensive, from the drawing, that he places the two sets of paddles too close together, by which the action of one set on the water may be diminished by that of the other set.

Patent granted to Alexander Nesbitt, *of Upper Thames-street, London, Broker, for a process by which certain materials may be manufactured into paper or felt, or a substance nearly resembling coarse paper, which is applicable to various purposes.* Communicated by a Foreigner. Dated July 27, 1824.

The material which the patentee applies to the purposes mentioned in the title is *moss*, which he describes "as being soft like wool, and being gathered in the *watering* places, ditches, and low grounds of Holland;" and the method directed for converting it into the substance stated, is to chop it in a machine for chopping tobacco, till it is reduced to pieces half an inch in length, after being previously well washed to free it from dirt, and then dried. The moss, when thus chopped, is to be left to soak for some hours in a tub of water, from which it is to be removed into a tub or vat, such as is used by paper-makers, whence it is to be taken up by common paper moulds, in the same manner as the pulp for making paper, so as to form a leaf or sheet. Each leaf so formed is to be placed between woollen cloths, and when a sufficient number of them are prepared, they are to be pressed altogether in a very strong press. They are after this taken out and placed on cords in the drying loft, and when thoroughly dry, they are again pressed between sheets of brown paper, and left in the press for three or four hours; after which the sheets are fit for use.

This material or moss paper, the patentee states, that he principally intends using for ships "between beam and plank," by which we suppose he means for sheathing paper, or the coarse paper commonly put between the sheathing and the planks of vessels. He further mentions, that great use is made of this moss in the navy and merchants' ships of Holland, for putting between the planks and the copper sheathing, where it is found to be very serviceable, and never rots.

The moss paper, he asserts, thus employed, would swell up as soon as it became wet, and would thus serve to prevent leaks. He thinks the moss for this purpose might be found in sufficient abundance in England; but if not, any quantity of it might be easily imported from Holland.

This process was communicated to the patentee by Mr. Wm. Van Houton, of that country.

As moss is little affected by wet, the soaking it in water for the time mentioned, after chopping, can have no effect in macerating it, as it has on linen rags, so as to fit it for making real paper; so that all that is performed by the process is, to produce sheets of moss strongly compressed, but having very little adherence between its fibres. It is, however, very probable, notwithstanding, that it might be very serviceable for the use pointed out by the patentee.

Much use is made of moss in caulking the large boats used on the Rhone, in performing which operation the method used is curious and singular. The moss thus used keeps the boats very staunch, though their shape is not well calculated to prevent leaks, they being both flat-bottomed and wall-sided. It lasts a long time there in the fresh water, and from the account of the patentee, the moss used in Holland is equally durable in sea water.

It is to be regretted that the patentee has not mentioned in his specification the botanical name of this moss, as his description of it is, from this omission, not so complete as could be desired. The moss used for the boats on the Rhone runs in length from two inches to three and a half inches, consisting of fibres of those lengths, closely surrounded from top to bottom by a pile, or tufts of a velvetty substance, about the eighth of an inch in length. From the description of the sphagnum palustre we should imagine, that if this moss is not exactly the same, it is at least of the same genus.

We must also notice, that the specification of this patent, having been evidently drawn up by a foreigner, contains some peculiarities in the language, which it might have been as well to have previously corrected.

The moss paper of the patentee seems very likely to have the beneficial effect which he mentions, when used under the sheathing of ships; and we therefore think it entirely deserving of a fair trial by ship-owners for this purpose, if they can prevail on their ship-builders to make the experiment.

LIST OF NEW PATENTS.

Thomas Steele, of Magdalen College, Cambridge, Esq. for improvements in the construction of diving bells or apparatus for diving under water.—Dated October 28, 1825.—Six months to enrol specification.

John and Samuel Seaward, of Poplar, Middlesex, engineers, for a new or improved method or methods of propelling boats, craft, and all kinds of vessels, on canals, rivers, and other shallow waters.—Dated November 1, 1825.—Six months to enrol specification.

William Ranyard, of Kingston, Surrey, tallow chandler, for a circumvolution brush and handle.—Dated November 1, 1825.—Two months to enrol specification.

Vernon Royle, of Manchester, silk manufacturer, for improvements in the machinery for cleaning and spinning of silk.—Dated November 1, 1825.—Two months to enrol specification.

John Isaac Hawkins, of Pancras Vale, Middlesex, civil engineer, for improvements on certain implements, machines, or apparatus, used in the manufacturing and preserving of books, whether bound or unbound.—Dated November 1, 1825.—Six months to enrol specification.

John Ridgway and William Ridgway, both of the Staffordshire Potteries, manufacturers of china, stone, and earthenware, for an improved cock tap or valve, for drawing off liquors.—Dated November 1, 1825.—Two months to enrol specification.

Thomas Seaton, of Bermondsey, Surrey, shipwright, for improvements on wheeled carriages.—Dated November 7, 1825.—Six months to enrol specification.

George Hunter, of Edinburgh, late clothier, for an improvement in the construction, use, and application of wheels.—Dated November 7, 1825.—Six months to enrol specification.

Thomas Shaw Brandreth, of Liverpool, Esq. for an improved mode of constructing wheel carriages.—Dated November 8, 1825 —Six months to enrol specification.

Samuel Brown, of Old Brompton, Middlesex, Gent. for improvements in machinery for making or manufacturing casks and other vessels.—Dated November 8, 1825.—Six months to enrol specification.

William Erskine Cochrane, of Regent-street, Middlesex, for an improvement in cooking apparatus.—Dated November 8, 1825.—Six months to enrol specification.

John William Hiort, Office of Works, Whitehall, architect, for an improved chimney or flue, for domestic and other purposes.—Dated November 8, 1825.—Two months to enrol specification.

Charles Louis Giroud, of Lyons, in the kingdom of France, for a chemical substitute for gall nuts in all the different branches of the arts or manufactures in which gall nuts have been accustomed or may hereafter be used. —Dated November 8, 1825.—Two months to enrol specification.

James Wilks, of Rochdale, Lancashire, tin-plate worker, and **John Erroyd**, of the same place, grocer, for an engine for cutting nails, sprigs, and sparables, on an improved system.—Dated November 8, 1825.—Six months to enrol specification.

John James Alexander M'Carthy, of Pall Mall Place, Westminster, for new or improved pavement, pitching, or covering, for streets, roads, ways, and places. —Dated November 10, 1825.—Six months to enrol specification.

Benjamin Cook, of Birmingham, brass founder, for a new method of rendering ships' cables and anchors more secure, and less liable to strain and injury while the vessel lays at anchor.—Dated November 10, 1825.—Six months to enrol specification.

Benjamin Cook, of Birmingham, brass founder, for improvements in the binding of books and portfolios of various descriptions.—Dated November 10, 1825.—Six months to enrol specification.

Johann George Deyerlein, of Mercer-street, Middlesex, smith and tool maker, for improvements on weighing machines, which machines he denominates German weigh-bridges.—Communicated to him by a foreigner.—Dated November 10, 1826.—Six months to enrol specification.

Samuel Parker, of Argyle-street, Middlesex, bronze and iron founder, and **William Francis Hamilton**, of Nelson-street, Long Lane, Surrey, engineer, for a certain alloy or alloys of metals.—Dated November 12, 1825.—Six months to enrol specification.

Edward Bowring, of Goldsmith-street, London, silk manufacturer, and **Robert Stamp**, of Buxted, Sussex, weaver, for improvements in the working, weaving, or preparing silk and other fibrous materials, used in making hats, bonnets, shawls, and other materials.—Dated November 17, 1825.—Six months to enrol specification.

James Guestier, of Fenchurch Buildings, London, Esq. for a mode or modes of making paper from certain substances, which are thereby applicable to that purpose. Communicated to him by a foreigner.—Dated November 17, 1825.—Six months to enrol specification.

Alexander Lamb, of Princes'-street, London, Gent. and **William Suttill**, of Old Brompton, Middlesex, flax spinner, for improvements in machinery for preparing, drawing, roving, and spinning flax, hemp, and waste silk. —Dated November 17, 1825.—Six months to enrol specification.

George Borradaile, of Barge Yard, Bucklersbury, London, merchant and furrier, for an improved method of making or setting up of hats or hat bodies.—Communicated to him by a foreigner.—Dated November 17, 1825.—Six months to enrol specification.

THE
REPERTORY
OF
PATENT INVENTIONS, &c.

SUPPLEMENT—DECEMBER, 1825.

Patent granted to JOHN M'CURDY, *formerly of New York, in the United States of America, but now of Snow-hill, London, Esq. for an improved method of generating steam.* Communicated to him by a foreigner residing abroad. Dated June 15, 1824.

INSTEAD of boilers for producing steam, the patentee proposes to use tubular chambers, which being brought to a due degree of heat by any of the usual methods, water is to be injected into them by a forcing pump, through a pipe an inch in diameter, that passes along the centre of each, and has small perforations on every side, through which it is emitted in "*sprees*" or small streams against the inside of the chambers. The water being then converted instantly into steam by the heat of the chamber, the steam passes off by a tube at its other end, to work the piston of a steam cylinder in the common manner.

From the bottom of each chamber a pipe descends, furnished with a cock, by which may be known whether the whole of the water injected each time by the pump be converted into steam; the quantity of which, to equal a four or five-horse power, should be about "half a gill.".

To add to the power of the engine the number of tubular chambers may be increased, together with the heat applied to them, and the portion of water injected. To cut off the communication between each separate chamber and the rest, in case of accidents, cocks are added to the pipes where the water enters them, and where the steam goes forth.

In using these tubular chambers, at first the forcing pump is to be worked by hand, till the pressure of the steam is found to be what is required, after which the engine is set to work, and moves the forcing pump or pumps with the rest of the machinery.

The patentee divides his claims relative to this patent into three heads; the first of which comprises the tubular chambers; the second the mode of distributing the water evenly in them by the perforated tube; and the third the method of getting a "head" or pressure of steam before the engine begins to work.

We understand that the general size of the tubular chambers which the patentee has tried, is 11 or 12 feet in length, and about six inches in diameter inside, and that they are made of wrought iron.

Considering the degree of risk from all engines of the kind above described to be of primary importance, we must observe, that the water or steam coming into contact with the red-hot iron of the chambers used in Mr. M'Curdy's plan, will be in part decomposed, and form more or less hydrogen gas, which, on mixing with a proper portion of atmospheric air, will be liable to explosion. It is true this danger will not be very great where care is taken to blow all the air out of the chambers by the steam, as long as they continue sound; but it is one, however, which never should be forgotten.

We do not agree with those who think there will be any saving by using these tubular chambers instead of steam-boilers; on the contrary, knowing the great wear of substance which takes place in iron, when exposed to heat, without being in contact with a liquid (which in the ponderous pots used in making prussian blue is often at the rate of two inches of their thickness from the outside in a month), we are inclined to suppose that the expence of frequently replacing the *burnt-out* tubular chambers would be much greater even in the first twelve months than the cost of boilers for producing an equal power of steam.

The patentee has not confined his transatlantic importations to machinery; he has also favoured us with a new word (sprees), the propriety of which we much doubt, at least in the sense in which he employs it. Its slang meaning is capable of a more legitimate authority *we guess.*

Patent granted to WILLIAM JOHNSON, *of Totham, Essex, Gentleman, for means of evaporating fluids; for conveying heat into buildings, for manufacturing, horticultural, and domestic purposes; for heating liquors in distilling, brewing, and dyeing; and in making salt and sugar, with reduced expenditure of fuel.* Dated August 5, 1824.

THE specification of this patent describes four methods of effecting the purposes of its title. In the drawing representing the first method three pans are placed, one above the other, so that the bottom of the upper one forms the top of that in the middle, and the bottom of the middle one the top of that which is lowest. Flanches project from the top and bottom of the middle pan, and from the bottom of the upper pan, and top of the lower pan, which serve for fastening them together steam-tight, by screws and nuts. For the pans above the lower one, the bottoms may be formed by plates put in between the flanches, and made tight by the means mentioned. These pans are to be furnished with tubes for conveying in and drawing off liquors (which are not shown in the draft), and for passing off the steam to other vessels, which latter tubes are to have valves, by which the pressure of the steam in the pans may be regulated by weights, and all of them are to have cocks, by which the communications can be opened or shut as required. The steam-pipes from the pans, in the draft, pass off sideways into one common tube, which enters a close vessel beneath an open pan, in which liquors may be boiled or evaporated by the waste steam of the others. The patentee states, that he has ascertained that a very large proportion of the steam at a high temperature may be thus conveyed off for useful purposes, after keeping up that of the pan from which it escapés to the degree of heat desired; and also that the heat of the lower pan being raised above boiling point by loading its valve, for instance, till the liquor in it is raised to 240° Fahrenheit, that in the pan above it may be brought to 230°, by the heat conveyed through its bottom from the former; and that in the upper pan to 214°, by the heat of that last mentioned. Of these pans the lower one is placed in a furnace, and exposed to the action of the fire in the usual method, and the upper ones receive their heat from it as described; and although only three pans are shown in the draft, placed as described, it may easily be conceived that a greater number may be arranged in a similar manner.

In the second method one large vessel, like the boiler of a steam-engine, is placed on the fire-place or furnace, in which several other flat pans, with close tops, are arranged one over the other successively, but with small intervals between them, to let the steam from the outside vessel act on all parts of them. For the admission of these pans, one of the ends of the outside vessel is so fastened on by flanches and screws and nuts, that it may be taken out when required. All these pans have pipes passing into them and from them, through the outside vessel, for the same purposes as those nentioned in the first method, and are furnished in like manner with cocks and valves; and the steam may be similarly conveyed from them to operate on other detached vessels.

The third method will be best described from the draft. In that three vessels are shown, one over the other, the top of the lower one forming the bottom of that in the middle, as in the first plan; but the top of the middle one and the bottom of the upper one being distinct, so as to leave a small space between them for the admission of steam, which is conveyed into it from the lower vessel, on which the fire operates, by two pipes that pass up from the latter into it, along the sides of the middle vessel. From this middle vessel the steam goes off into the upper one by a pipe in its centre, which passes through the interval between them sufficiently high to rise above the liquor in the upper vessel; and from the top of this upper vessel another pipe conveys the steam from it where it is desired to operate.

The fourth method seems to be a combination of the first and second. In it the lower pan, which is exposed to the fire, contains one or more close shallow vessels, managed in all respects as those in the second plan; above them it has a close top, which serves as a bottom to an upper vessel, as represented in the draft; from all these vessels steam-pipes pass into a detached close vessel, as in the first method, on which an open pan is fixed for evaporating or other uses, and tubes also pass into them for conveying liquors into and from them, all which pipes are furnished with cocks, and those for the steam with valves, in a similar manner to the method first described.

In all the several methods the bottoms of the pans are to be sustained by ties, in the same manner as that used for the bottoms of steam-boilers, when they are large enough to require this precaution; room being left in them to put in and take out the keys by which the ties are connected.

How these plans of the patentee were to be applied to horticultural purposes, as stated in the title, excited in us some curiosity, which, however, was not gratified, although, from the great length of the specification, such information might have been expected. Its excessive length is, however, occasioned by incessant and useless tautology, instead of affording the desired explanations of the processes announced.

Various patents have been obtained previous to this for the application of steam to boiling and evaporating, of which a very useful one may be seen in p. 74 of our 44th vol. second series. The methods of the patentee, however, differ from them in the use of inclosed vessels as described.

This plan might be of service for liquors that left no sediment, or in which no salts crystallized, and which consequently required no passage to the pans for removing the salts, or for cleaning them out; but this proviso limits its use to such a narrow compass, as to render its benefit extremely problematical.

We cannot, for these reasons, conceive how the combined boilers can be at all used for preparing common salt or sugar, unless the steam from them be applied to act beneath open pans, which the patentee repeatedly disclaims as being within the limits of his patent; which he very properly does, the method having been before secured by former patents.

In short, the application of the plans of the patentee to useful purposes seems still a desideratum, which will so far secure the exclusive use of them to him, as no other person, probably, will be able to imagine or comprehend a secret so very profound, and so artfully concealed. We shall, however, just beg leave to mention in conclusion, that so far as these plans (if any) are secured by secresy, so far are they unprotected by the patent.

Patent granted to FREDERICK BENECKE, *of Deptford, Kent, Verdigris Manufacturer,* DANIEL TOWERS SHEARS, *and* JAMES HENRY SHEARS, *of Fleet Market, London, Coppersmiths; for improvements in making, preparing, or producing zinc or spelter.* Communicated to them by a certain foreigner. Dated October 7, 1824.

THE specification of this patent commences with pointing out the defects of the common method of making zinc, which consists of urging the ore by fire in a vessel, from the bottom of which a pipe descends into water, in which method the other metals, mixed with the ore, particularly head, are melted and pass down along with it in the state of alloy. It then describes an apparatus, by the use of which this evil will be avoided, and the zinc produced be more pure, by passing off from it laterally in the state of vapour before it is condensed into metal. This apparatus consists, in its most simple state, of a long narrow vessel, of the refractory clay, used in making crucibles, which may be either hexagonal, cylindrical, semicylindrical, or of, various other forms, and which is to be placed horizontally in a furnace, for the reception of the ore. The front or mouth of this vessel is fitted with a stopper, towards the upper part of which is a circular aperture, for the reception of the neck of an earthen globular head; and towards its lower part a square aperture, for extracting the calx or remains of the ore after distillation, which latter aperture is furnished with a stopper, to be luted into it when the vessel is at work, as is also the primary stopper into the vessel itself. The globular head, besides the neck, has another tube, which descends from it, and which may be lengthened by luting additions to it till of a proper length for cooling the vapourized zinc, which falls from it as soon as condensed upon an iron plate, placed beneath for its reception. In the front of this head is a round aperture, through which the ore is put by a scoop into the vessel beyond it, which opening is fitted with a stopper, which is luted to it when in use.

Two sorts of furnaces are described for the vessels fitted up as mentioned. In the first, ten of them are arranged on one level hearth, supported a little above it by bricks, and placed in two rows, with their heads outwards, and the tubes depending from them. A small space is left between their inner ends, and in the middle of this space an oblong opening forms a communication with the fire-place beneath it, from which the heat and flame ascends, circulates through the vessels, and passes out above through openings in a low arch, which covers all the vessels, and forms a reverberator for reflecting down and confining the heat. Under the grate of the fire-place the ash-pit communicates with a large culvert or arched passage, that admits the air from beyond the limits of the building; and through one of the ends of the mass of brick-work a sufficient space is left for access to the fire-place, to supply it with fuel. We have left the heads projecting from the vessels beyond the furnace or oven; but as it is expedient that they should be kept warm, a small cell or nitch is made for each of them, by building their walls between them, arched at top, and having metal plates across them, at the level of the bottoms of the vessels; through apertures in which plates the tubes from the heads pass down near to other metal plates at the level of the floor, on which the zinc is deposited as it is formed.

By this arrangement the head of each vessel will be in a small square cell by itself, joined by its neck to the stopper of the vessel for the ore, at which part the openings round the vessel are to be filled up by pieces of bricks and luting, to close the back of this little cell; and to its front a moveable door or lid is to be fitted, which, when luted in, confines the head entirely from view. This lid is composed of an iron frame, with iron wire passed across it in both directions, so as to form a sort of grating, which is to be plastered at both sides with luting; and in the middle of this grating a small opening is left, inclosed by a similar iron frame, furnished also with its stopper, which opening being opposite that in the head, serves to give access to it for putting in the charges of ore.

In the second sort of furnace the vessels are placed in several tiers, above one another, six or seven being in each tier. The necks of the heads or tubes serving for that purpose pass through the front wall of this furnace, which is built up of loose bricks and luting between the outer ends of the vessels. Beneath all is placed the fire-place, which is covered by a brick arch, to prevent the fire acting too violently on the lower vessels; and through it apertures are left, through which the fire ascends, and circulates through the spaces left for it round the vessels. Over the upper vessels is a brick arch, with apertures in it to let off the smoke; and just above this arch is left a passage, through the wall in front, closed by a door or stopper, by which the apertures in this arch may be closed or opened as required. The method of arranging the heads and distilling tubes in this latter furnace is not described.

The apparatus being thus prepared, black jack, blende, or sulphuret of zinc are taken, and roasted either in a roasting furnace, or else stratified in alternate layers with fuel, and roasted by setting fire to the pile. The ore is then spread out in the air, watered, and lixiviated, to separate the sulphate of zinc; after which it is roasted a second time, and then powdered fine, and mixed with an equal portion of powdered coal, charcoal, sawdust, or other carbonaceous matters, particularly with cinders, and then by scoops put into the vessels through the doors of the nitches and the heads, as mentioned, to the thickness of an inch or two. Calamines, or oxides of zinc, only require the latter part of this process. The openings being then all luted, the first charge is to be distilled as long as the zinc comes from it; then a second charge is to be put in, and managed as before; and after that other charges successively, as far as the vessels will hold them, so as to perform the work to advantage. After this the doors of the nitches are to be opened, the heads to be taken down, and the calces and residuums from the ore to be drawn out through the square openings in the stoppers, in the front of the vessels. And then again, the heads, doors, and stoppers being placed as at first, the operations described are to be repeated as before.

The patentees state that much depends upon regulating the fire, so as to keep up a regular heat at the same temperature throughout the process; and this they effect by putting the coals into the fire-place in small quantities at a time, frequently renewed; also by having a large culvert to admit the air evenly, without any quick draft or blast;

and by letting the smoke escape through apertures in the arch of the oven or furnace for the same design, without using any chimney to accelerate its current. They also mention that they use, in some cases, pearl-ash or sea salt, or slaked lime, along with the powdered ore and coal in distillation, for the purpose of increasing the produce of zinc.

The construction of the receivers, heads, and tubes, their mode of arrangement and connection, and the structure of the furnace first described in this specification, are all evidently the work of some person of great experience in the large operations of chemistry, and contrived in a masterly manner. Of the second furnace we can only say, that in our opinion the patentees had better have said nothing about it than to have left the most difficult part of the arrangement respecting it undescribed, which leads to the supposition that they had in fact never perfected the mode of its application.

The lateral method of distilling zinc, claimed by the patentees as an improvement of their invention, will, we apprehend, be a point very difficult for them to maintain, since Mr. W. E. Sheffield, in the specification of a patent he obtained several years since, for separating metallic substances from their ores, describes the use of lateral tubes from his pots, for letting the zinc pass in that direction in the state of vapour to the place in which it is to be condensed. We have also to observe, that the same process has been long practised, even before any of these patentees were in existence. In fact, so many have been the methods in which vessels of all shapes and kinds, and in all positions, have been used in chemical processes, and particularly in those relating to metallurgy, that we apprehend it would be most difficult to contrive any which had not been before employed.

It has been acknowledged by the first chemists, that the present mode of getting zinc from the ore is very defective.

We have still the same complaint to make, as the processes of the patentees by no means tend to remove it. In the roasting the sulphurets, as directed, much of the zinc must be lost, and in this part of the business at least no improvement has been attempted. As to the employment of pearl-ash, sea salt, or lime, which the patentees mention, with ore prepared as they state, we may be well excused in doubting its advantage; they not having explained it, and there being no chemical theory, ancient or modern, which would lead us to expect the smallest benefit from the action of these substances on the ores of zinc, in conjunction with carbonaceous matter, exposed to heat in the manner directed by the patentee. On the contrary, we should rather think them injurious, from their tendency to vitrify the oxides contained in the ore, and convert them into a slag instead of metal.

Patent granted to WALTER FOREMAN, *of Bath, Esq. Commander in the Royal Navy, for improvements in the construction of steam-engines.* Dated October 7, 1824.

THE steam-engine described in the specification of this patent is of the rotary kind, in which a vertical cylinder is to revolve within a fixed annular case, that encompasses it by the pressure of the steam on valves, attached by hinges to the cylinder, which are pressed close to it by a wheel projecting from a stop within the upper part of the case, and again move off from it by their weight when their hinges pass the horizontal diameter. The steam enters at one side of the case by a tube, and passes out at the opposite by a similar tube, after having acted on the valves.

The cross section of the annular case would form a trapesium, whose base next the cylinder would be longer than its top, towards which its two sides would slope in equal angles. The whole figure therefore of this case would be, in strictness, at each side a very flat obtruncated cone; which conical figure would not be particularized here, so little is it perceptible, and so inconceivable is its use, but that it is set forth by the patentee as one of the chief points of *improvement* which he expressly claims. The valves must of course be shaped at their sides according to the section of the case just stated, which shape forms another particular claim; and they are also represented in the draft that accompanies the specification, as being curved in the other direction, or flatwise, so as to lie close to the cylinder when pressed down to it by the stop at the top. These valves are six in number in the draft, and are separated from each other by narrow cross pieces screwed to the cylinder, to which their hinges are attached. The stop is formed hollow, in two pieces, one of which slides downwards within the other, and both are fastened by screws within the case so as to be steam-tight; the sliding formation of the parts is to admit of occasionally lengthening the whole in the direction of the radius, to supply the wear of the side next the valves. From this stop a spring piece descends in the case to near the horizontal diameter, where it sustains a vertical wheel, that is nearly of the diameter of the section of the case; the circumference of which wheel rolls over the valves as they are forced beneath it by the steam, and press them successively against the cylinder. This wheel and spring piece constitutes the third and last particular claim of the patentee in this engine.

There being no mode described of making the parts of this engine steam tight by packing, they must be all made so by accurate workmanship and grinding, the expence of which in the onset, and in the repairs, would certainly be too considerable to allow it to come into competition with other steam-engines of a more common and practicable construction.

This engine is similar in its principles to one contrived by Mr. Cook, more than 30 years ago, which is described in the third volume of our work, first series, and which we could never learn was ever carried into effect, though much less complicated, and affording more facilities of construction than that which is the object of the present specification.

Patent granted to JOSEPH ASPDIN, *of Leeds, Bricklayer, for an improvement in the mode of producing artificial stone.* Dated October 21, 1824.

THE patentee states that this artificial stone is a cement, to be called Portland cement, which is to be employed for stuccoing houses and water cisterns, and for other uses. To form it, he directs that "*puddle*" or powder from roads laid with limestone, or the limestone itself used for that purpose (when the other material cannot be procured in sufficient quantities), should be calcined, and when slaked should be mixed with a "*specific*" quantity of clay and water to an "*impalpable*" state, by manual labour or by machinery, and should then be put in a "slip pan," and be dried by the sun, or by fire flues beneath the pan, until entirely deprived of the water. The whole is then to be broken into lumps, and again calcined in a lime kiln, after which it is to be reduced to powder by grinding, rolling, or pounding, when it will be fit for use.

The above are the whole of the directions given for preparing this cement, in which it will be observed that neither the proportions of the clay to the lime, nor its previous preparation, are stated.

The general outline of the method, however, is the same as that published by M. Vicat many years ago, and we understand practised in this country as well as in France since 1820. M. Vicat directs that from 0·15 to 0·40 of the clay should be used with the lime, according as the limestone is more or less rich, or contains less of extraneous substances, 0·20 being a good proportion in general, and that the clay should be freed by any of the usual methods from any gravel which it might contain.

Relative to the use of road materials from roads made of limestone, to which the patentee seems to have a singular predilection, we have made some observations in treating of another of his patents, in our third number of this series; and shall close our remarks on this patent by expressing strong doubts whether a specification, which describes a cement or stucco only, can satisfy the proviso of a patent granted for *making artificial stone*, so as to make it valid, even if the circumstances beforementioned did not so powerfully operate to its prejudice.

Patent granted to JOHN HEAD, *of Banbury, Oxfordshire, Hosier, for improvements in machinery for making cord or plat for boot and stay laces, and for oth.r uses.* Dated November 4, 1824.

THE machine for which this patent was granted is described as applied to platting twelve threads into one hollow cord, in the centre of which a solid cord of any kind, of a fit size, may be inclosed or not, as thought proper; but it is evident other machines, on the same principle, may be made so as to plat a greater or less number of threads in the same manner, provided they are in even numbers, as stated by the patentee. The engine for platting twelve threads has six axles, placed vertically, at the same distance from a common centre, and each axle carries a horizontal spur wheel, the teeth of which work in those adjoining, so that the whole six are put in motion by moving any one of them; but of course from the action of their teeth they revolve alternately in opposite directions, which is necessary for the proper movement of the bobbins. These axles are placed in a plane frame, formed of two hexagonal rails, connected by a due number of uprights.

Above the upper one of these rails are fixed two horizontal metal plates, with a small interval between them, through both of which the six axles pass upwards a short space. The lowest of these plates is left unaltered; but in the upper one is cut out six circular cavities, one round each spindle, in such a manner that their circumferences intersect each other so as to leave open spaces between each pair, for the passage of the bottoms of the bobbin holders from one circle to the other. These bottoms are of an oval shape, of about half the radius of the open circle in breadth, and on each spindle is fixed a circular button or knob between the plates, of nearly half the diameter of the open circle, which button confines the oval bottom of the bobbin holder to move in the track between it and the edge of the circle; and to secure the oval bottom from rising up from this track, a small oval plate is fastened below it, the edges of which project a sufficient distance to come under the cut plate. Two bottoms of bobbin holders are placed in each of these circular tracks, but at opposite sides; and to put them in motion, four arms are fastened to the top of each of the six vertical axles, one pair of which are placed over the other pair, and so as to form a cross, and their length being such as to pass a small distance over the adjoining circular tracks, they would impede each other's motion were it not for the precaution taken, just mentioned, of placing every second pair in a different plane, which causes the ends of the upper pairs to pass close over the others without touching.

The consequence of this described arrangement will be, that, when the axles are put in motion, the bobbins will be driven by the revolving arms from one circle into the next; but, on account of the spindles and their arms moving alternately in opposite directions, they will pass alternately from the external part of one circular track to the internal part of the next, and from that to the external side of the ensuing circle, so as to pursue altogether a serpentine course round the frame; six of the bobbins following one another in the same track, while the remaining six are made to move in the opposite direction, crossing the tracks of the others in passing from one circle to the next, so as to interweave the threads that proceed from them all to the common centre, where they meet to form the cord.

The bottom of the bobbin holder described performs an office so essential to the operation, that it may in fact be considered as a distinct part, to which the bobbin itself is secondary.

From this bottom part a stem rises up, which has two small plates proceeding at right angles from it, between which the bobbin is placed in a vertical position, in which it is retained by a pin or spindle that passes through its centre, and through the upper plate, and turns in a cavity in the lower plate. The bobbin itself is of the common form, made of metal, with a hollow body, and about four inches in length. To prevent the thread from coming too quickly from it, the following method is adopted: the surface of its upper disk is indented with notches, into which a catch falls from the upper plate of the holder, where it is jointed, and has another arm so placed, that when it is raised up the catch rises with it, and permits the bottom to turn round which it before prevented from moving; two wires being fixed parallel to the back of the stem, and between the three a small weight being placed so as to be moved up and down, the thread from the bobbin first passes through a hole in the stem, then ascends through a hole in the upper plate, and passes downwards again through another hole in the same plate; then passes through a wire loop in the small moveable weight, from which it again ascends through a third hole in the upper plate, and from thence goes upwards, to join the other threads in the common centre, where they form the cord. By this arrangement, as the thread is woven up, the little weight will be made to rise till it comes in contact with the longer arm of the catch, by which it will raise the latter, set the bobbin free, and then fall down again instantly, drawing from the bobbin at the same time a fresh supply of thread, for continuing the work as before. The catch is then again pressed against the top of the bobbin by its little spring, and prevents its turning till the weight again rises to raise its arm. The centre, where all the threads meet, is placed at some inches' height above the machine, where the cord, as it is formed, passes through a hole in a small plate, and over a pulley, from whence it proceeds sideways, in a horizontal direction, to two revolving rollers, which draw it off and deliver it from between them into a basket, placed beneath for its reception. The rollers are turned by an upright axle, placed at one side of the machine, the top of which carries a screw that works in a toothed wheel on one of the rollers; and on its lower part is fixed a toothed wheel, which acts on one of the six toothed wheels of the machine before described, and thus gives motion to the whole; the power which is used for this purpose being first applied to this axle, as the part most proper for its communication.

This is an ingenious little machine; but on account of the draft of the thread from the top of each of the bobbin holders pressing it towards the centre, a binding will be caused on the bottom part, which will make them move stiffly and unevenly. This might be much remedied by causing the thread to pass ultimately from near the bottom of the bobbin holder to the central pulley, instead of from its top.

Mr. Heathcoat, of Tiverton, obtained a patent for a machine for the same purpose as this invention of Mr. Head's, in November, 1823, which, though much more complicated, has its bobbin holders contrived so as to move with much less friction, and a great deal more evenly and steadily.

Patent granted to James Gunn, *of Hart-street, Grosvenor-square, Coachmaker, for certain improvements in wheeled carriages.* Dated October 14, 1824.

The first thing described in the specification of this patent is a method of constructing the lower part of the bodies of stage coaches, which may be understood by supposing a stage coach of the kind most in use at present (with the fore and hind boot attached to the body) which, instead of having the pannels of the body to come down close to the bottom, had them short of that by 12 or 14 inches, so that its general appearance would be that of a very low body, having beneath it a case, seeming to be a continuation of the hind boot, and of the same construction and colour; but this lower part, instead of being what it seems, is in reality the lower part of the body, the seats being on a level with the bottom of the pannels, and this apparent case constituting the receptacle for the feet of the inside passengers, and the space beneath the seats. The door of this coach not coming down lower than the bottom of the pannels, its place is supplied in the lower part by the step of the carriage, which is made large enough to supply its place there, when turned up, being fitted properly into the lower part of the door frame for that purpose, and thus performing the double offices of step and door, so far as it extended upwards. To secure this same part further, the patentee directs that an iron frame, with grooves, may be fixed round it, into which an iron plate is to be fitted, so as to slide in tight, which, in case of the coach having to pass through water, is to be pushed down into the grooves, which, according to the specification, will prevent the entrance of the water into the body of the coach.

Next after this follows the account of the fore boot, of which the lower part is to turn horizontally along with the fore wheels; the futchels, and other parts necessary for forming the connexion with the axle and the pole, being attached to its bottom. To form the revolving joint of this part, a grooved ring of iron is fixed to it, of the diameter of its breadth, in the groove of which a projection in a similar ring, attached to the upper part that is united to the body, enters; and bars being fixed across the diameters of each of these rings, from the centre of the upper one a pin or bolt descends, that enters into a socket in the lower one, which being fastened below by a cross key, prevents them from separating. These rings may also be formed so as to act without the bolt or cross bars, by the projecting ring being made wider at its lower part, and the groove in the lower ring formed to fit it. The rings may likewise be made flat (without grooves or projections), and be kept in contact by four or more horizontal rollers, fixed to the upper part of the boot, close round the moveable ring, at equal distances from each other, the rings in this case having cross bars and a central bolt, as in the first plan. A variation may besides be made in the positions of the rings; that which was directed to be attached to the upper part of the boot being fixed to a lower moveable portion, and the other on the contrary occupying the former place of this one.

The lower revolving part of this boot is to be fitted up to form a safe receptacle for valuable property; its sides, inside the wood work, are to have circular plates of iron all round them in every direction, fastened by their centres alone; so that if an attempt be made to cut into the sides of the boot by the large centre bits, which thieves use, the farther progress of the bits, when they come in contact with the circular plates, will be rendered impossible, by the plates turning round their centres as the bit revolves. The passage into this receptacle may be either through the upper part of the boot, or through the back part of the receptacle, which latter appears to be preferred, from its position requiring it to be turned round so that the pole, which moves along with it, shall be nearly at right angles to the body of the coach before it can be opened, by which the difficulty to thieves of getting at it when it is on a journey will be greatly increased. The door of this receptacle is to be fastened by bolts, having locks close beside them, so placed that, when the bolts are pushed in, on the lock being turned its tongue or bolt enters into a cavity in the bolt next it, and prevents it from being again drawn back.

To convey bank notes or money, divisions are formed in this receptacle in the revolving part of the fore boot, into which iron boxes for holding them being thrust from behind, are prevented from being drawn out, by chains placed diagonally across the entrances to the divisions, and fastened by padlocks, over which the door of the receptacle is closed by the means just mentioned. And to still farther secure this receptacle, an alarm is so connected with its door that, on this being opened, a ring slips off a pin that confined it, and lets go the alarm.

A considerable space is occupied in the description of this alarm and its varieties; but a general notion of it may be formed by conceiving an axle with a small wheel on it, from the rim of which several catches project, that act against either spring plates or the shanks of hammers; and that this axle is so connected with a spiral spring, that on its being wound up, and the ring placed on the pin before mentioned, as soon as the ring is forced off the pin again, the spring turns round quickly, and causing the axle to revolve along with it, by means of the catches forces the plates or hammers to rise, which in their fall causes a noise that cannot fail to attract the attention of all within a considerable distance.

The fellies or streaks of the wheels for this coach, or others, the patentee states, will be improved by having small plates fastened at each side over their points of connexion, and by having metal knobs fixed to their rims, so as to enter into corresponding cavities in the ring-tire which goes round the wheel. This latter part may be varied by having the knobs fastened to the ring-tire, and the cavities for them formed in the outside circumference of the fellies.

To the side plates, at the joinings of those fellies on the inside of the hind wheels, are to be fastened rings or hooks, for the purpose of holding a drag chain, or a piece of bolt iron serving for the same use, that is attached at the other end to the hind boot, at a sufficient distance from the axletree, and which, when hooked on to those plates, prevents the wheel from turning.

The patentee, after this, describes particular formations for the ends of the axles and boxes of the naves, the object of which is to secure the wheel better from separating from the axle accidentally. In the first of these methods a collar or ring is placed on the inner part or shoulder of the axle, and another collar screwed on outside it, to keep it from being drawn off, which screw-collar is to be farther fastened by side pins passing through it; and the inside part of the box of the nave being made sufficiently wide next the shoulder to contain these two collars, when put in its place is to have screws passed through this enlarged part into the loose inside collar, which then revolves along with it, and prevents the wheel from coming off by its action against the fixed collar. Another method described for the same purpose consists in having the outer extremity of the axle made hollow, to contain the cylindrical head of a bolt made so as to turn round freely within it; a round collar is then passed over the bolt, and having a screw cut round it, which fits in a corresponding hollow screw at the end of the cavity in the axle, is screwed into it so as to keep the head of the bolt securely within it. This bolt passes through a hole made for it in a plate, that is fastened on the face of the nave, outside which a nut screws on it, over a washer, and a pin passed through the nut afterwards keeps it from turning so as to come off again from the bolt. It is obvious that it is the head of this bolt that will then chiefly keep the wheel from coming off, and that the advantage of the contrivance will lie in tending to prevent the nut and screwed collar from being turned off, by the bolt itself moving round with the wheel. The patentee further directs the use of axles hollowed through their whole extent, as being stronger than solid axles of an equal weight, and points out a method of converting part of this hollow into a vessel for holding oil, for lubricating the part of the axle that enters into the nave.

The following method of arranging the springs that support the coach is also described in this specification. These springs are to be of the straight flat kind now commonly used for stage coaches, and to be placed like them, underneath between the body or boots and the axles, but differ from them in arrangement, three of them being placed at each point of support, so that twelve, altogether, will be used for the coach. Of those three one is attached by its middle to the axle in the usual place, and to each end of this one the middle of one of the others is jointed beneath; the farther ends of these two secondary springs are then jointed in the usual manner to the bottom of the body or boots, and their ends next the axle are joined by links, either to the axle itself, or to the primary spring near to the axle, this latter point not being explained in the specification.

There is no apparent advantage in the mode of forming the under part of the body of the coach as directed in this specification. Part of the door being composed of the step, would, in our opinion, be awkward and inconvenient; and the sliding metal plates for keeping out water would, we apprehend, be quite ineffectual for that purpose, it not being possible to make a water-tight joint for them according to the directions given in the specification for their construction.

The construction of the fore boot seems well contrived for the security of property put into it, and the circular plates for preventing the action of centre bits likely to be serviceable on other occasions, particularly for the defence of doors and window shutters.

The method of strengthening the connexion of the fellies of wheels, by side plates at their joinings, has been before used, particularly for artillery wheels, from a very remote period.

The first plan for the construction of the boxes of the naves and the ends of the axles appears to us very similar to others which have been long since made public. The axletree and box, for which Mr. Rowntree took a patent in April, 1805, are evidently formed on similar principles, as are those likewise for which a patent was granted to Messrs. Barclay and Cuming, in May, 1814, although not so nearly the same as the former. The other plan for the same purpose appears somewhat new, although so many methods have been used for the same purpose that we should not wish to affirm very positively that it is so.

The hollow axles deserve a trial, although we should not like to trust to those made so at the shoulder; perhaps, if axles were made solid about this part, and hollow in the rest of their extent, they would be preferable.

Patent granted to JOHN LANE HIGGINS, *of Oxford-street, Middlesex, Esq. for certain improvements in the construction of the masts, yards, sails, and rigging of ships, and smaller vessels, and in the tackle used for working, or navigating the same.* Dated 7th July, 1824.

THE greatest part of the subjects of the specification of this patent, relate to the rigging of sloops.

In the first method directed for this purpose, the boom is prolonged forward before the mast as far as the head of the vessel, and a stay connects this end of it with the top-mast; the gaff also is extended forwards, and being at the same time bent downwards in a curve, joins the stay mentioned, about a third of the distance from the top to its lowest extremity, when the former is at its greatest elevation; but as it is necessary that this gaff should be lowered, when the sail is required to be reefed in the way directed by the patentee, its lower end traverses up and down on the stay by a roller, which confines it to the stay without impeding its descent or ascent. A single sail occupies the whole of the space between this gaff, and stay, and the boom; it is laced to the gaff in the usual way, and is joined to the stay by rings called "cringles," and in this way it serves the purposes both of mainsail and foresail; the reefing laces are at the bottom of the sail, but are not arranged parallel to the boom, but to a line drawn from its aft end to the lower extremity of the gaff; and as this latter is lowered are taken up below, and the gaff being brought more forward by its connexion with the stay, as its fore end is brought down, its upper end still maintains nearly the original elevation, and only approaches nearer to the mast, which accounts for the disposition of the reefing laces just mentioned.

The patentee also proposes, in place of the single mast usual for sloops, to erect two in the same line across the vessel, each being about an eighth of the breadth of the vessel from the centre, as far as can be judged from the drawing; these two masts ascend parallel to each other, but are joined at top either by a cross piece strengthened by iron diagonals, or by two curved pieces scarfed to their extremities, which make their connexion assume the figure of a gothic arch; a topmast is attached to them in this part, and they are all three connected to the sides of the vessel by shrouds and stays in the usual manner. The long boom lying then between the two masts, the sail will not be impeded by them more on one tack than on the other, as would be the case with a single mast.

For large ships a bowsprit is to be used, but for small vessels this may be dispensed with, and instead of it a spar fastened to the fore end of the boom be employed, of sufficient strength to carry the jib-sail. In this mode of arranging the sails, particularly in that last mentioned, on each tack the fore end of the sails will traverse over to the windward side of the vessel, from which the patentee expects great advantages; one of which is obvious in its causing the weight of the fore end of the boom and of the spar to pass to that side of the vessel, and so far counterbalance the pressure of the wind in inclining the sails to the leeward, but of the other advantages seamen alone can judge.

Where a bowsprit is used, the patentee directs that the jib-boom be fastened at near its middle to the end of the bowsprit, so that its aft end can traverse across the forecastle by a ring and curved spar, or iron bar, prepared for it, (in the way usual for the moveable angle of the fore-sail in some sloops,) and that its fore end be turned to windward as required: he also mentions that the boom may be made double, of two pieces a little curved, and hooped together at their extremities, so that when a single mast is used, it will be in the middle between the two pieces. In one of the figures in which the boom and bowsprit are joined in one piece, the gaff is represented passing down in a curve entirely to the fore end of the united piece, like the bowed yards or gaffs, used for tartan-rigged vessels in the Mediterranean.

The patentee directs a new method for rigging a gaff topsail; instead of its being laced to the topmast in the common method, it is to be fastened at that side to a yard, placed parallel to the top-mast, and attached to it by its middle: the point of this triangular sail is to be fastened to the aft end of the gaff as usual, and a brace, or rope, passing from each end of the yard to the deck, either end of it may be brought down as required, according to the tack in which the vessel is steering. By this plan the gaff sail may be put up without sending any man aloft, pullies being previously placed at the proper situations on the top-mast, and on the end of the gaff, with ropes reeved through them, ready for taking up the yard and sail, when it is wanted.

For ships and other large vessels, the patentee directs a method for rigging the jib-sail somewhat different from that before-mentioned, which is by having a boom or yard attached to the bottom of this sail, instead of the jib-boom, which is to be fastened to the end of the bowsprit, so that two-fifths of it may project beyond the bowsprit, and the other three-fifths run aft above it; two ropes being fastened to the aft end of this boom, and one of them being brought over either side of the bow, will serve to turn the fore end of the boom and jib to the windward, as required, in a manner similar to that described relative to the former jib.

A method is also directed for bringing the tacks of the fore and main-sails, in two masted vessels or ships, to a wheel on deck, by which the patentee states they can be managed with much more facility.

Of the plans of the patentee, that in which the boom is extended forwards, and placed between two masts, seems the most likely to be beneficial; as the sails used with it will have all the advantages of lug-sails, which are much estemed for quick sailing by seamen, without requiring to be shifted as these do, to have their full power on the different tacks.

The two masts might also be placed like a pair of shears, for the same purpose, and if fixed over a beam, and fastened to its extremities, and to the sides of the vessel by substantial and well managed iron work, would give so much support in the direction of the shrouds, that probably some of them might be dispensed with, which in addition to what would be saved in the shears costing so much less than the mast, would occasion considerable economy in the rigging. The shears combined in this way with the beam, would form a triangular frame, which is well known to be the strongest, and any additional weight thrown by them on the end of the beam might easily be supported by stanchions properly disposed.

Patent granted to Herman Schroder, *of Hackney, Middlesex, Broker, for a new filter.* Dated August 11, 1824.

This filter consists of a wide bag pleated in longitudinal folds, and inclosed within a case of metal, wood, ticken, or other materials, a little longer than itself, to prevent its being torn by protruding beyond its limits. The ticken case is preferred on account of its cheapness; calico is mentioned as a proper material for the filtering bag, though other substances would also serve for the same purpose; and its dimensions are particularised in one instance as being six feet round and two feet deep, but are not confined on all occasions to these limits; the case is to be made much narrower, probably less than a third of the width of the bag, that it may confine it, so as that it may always lie in longitudinal folds. A conical metallic funnel, with a screw at its smaller end, connects the bag and case with a vat placed above them; into the bottom of which the small end of the funnel is screwed up: and the filtering bag and its ticken case are fastened to this funnel by a ring somewhat narrower than its wider part, which is first passed over its neck; and the case and bag, being then drawn up between the ring and the funnel, are turned over the former, and fastened beneath it in any manner convenient. This mode of connecting the bag with the funnel will cause it to be pressed tighter to the latter, in proportion as the weight of liquor within it is greater.

Several of these filters may be fastened, in the manner described, below the bottom of the same vat, care being taken to leave sufficient space between them, that they may not touch one another when filled with liquor.

A clause in the specification, relative to the varieties of materials and dimensions of the bag and case, directs the latter to be always about the proportions stated, and among the materials for the case mentions netting. It also states that two or more bags may in some cases be used one inside the other, to give more strength, prevent the ill effects of accidental holes, and to render the filtration more perfect.

It would seem, from the directions given relative to this filter, that the patentee had some particular application of it in view; but as he has not explained himself on this point, it can only be the subject of conjecture.

Among the materials mentioned for the cases, netting seems to have advantages not noticed by the patentee, as it would not be liable to interrupt the passage of the liquor through the filtering bags, which the other sorts of cases mentioned would do, more or less, as the outsides of the bags would be much pressed against them by the weight of internal liquor, and its passage between them and the cases obstructed proportionally.

Patent granted to PHILIP WEISE, *of Tooley-street, Southwark, Surrey, Manufacturer, for certain improvements in preparing and making waterproof cloth, and other material for manufacturing hats, bonnets, caps, and wearing apparel.* Dated October 14, 1824.

THE materials of which the articles recited in the title of this patent are to be made are very miscellaneous; among them are enumerated beavers' fur, the sort called neuter, musk wool, the fur of hares' backs, Saxon wool, lambs' wool, flax or hemp, carded silk, and down or feathers. The proportions of these are to be 5 lb. of the finer furs, 2½ lbs. of the wool, 2 lbs. of the flax, 1 lb. of the carded silk, and ¾ of a pound of the down or feathers, as nearly as we can recollect. These materials are to be divided into portions of about two ounces each, and to be passed through a fine carding engine by one portion at a time, the fine fur being first laid or bowed on the roller cloth of the engine, which will cause it to lie on the outside of the carded flake. After being thus carded, the materials are to be drawn, roved, and spun, like cotton, the management directed for them being the same as is used for that substance.

The yarn spun is to be of two sorts, one fine, for the warp, and the other coarser and softer, for the weft. It is then to be woven in a loom of from 8 to 12 "lambs," and a proportional number of threadles. The fine yarn forming the warp is to be kept at the back of the cloth, and the soft weft in the front, by the means well known to weavers, and similar to those used in weaving diapers and velvets.

When the cloth is wanted to be made waterproof, a composition is to be prepared of equal portions of shell lac, caoutchouc or elastic rubber, mastic, gum animi, and sandarac; by cutting the caoutchouc into very small shreds, and pounding the gums and lac very fine, and then dissolving them in "spirits of wine," or spirits of turpentine. Into this composition the fine skeins for the warp are to be dipped, and then to be gently pressed or left to drain, and to be hung up to dry; and when dry, are to be stretched in the loom, where, instead of the common sizeing, the composition above stated is to be used.

After the cloth is woven, the fur or nap is to be drawn forward on its front by teazles or cards, and a hot smoothing iron is to be passed over its back, to cause the composition to sink into it, and close the interstices.

This cloth, when intended for hats, is to be laid over linings or moulds, on hat blocks, of the same materials usual for those of silk hats, and to be managed in the same manner.

For wearing apparel the cloth is to be chiefly made of Saxon wool and flax, managed as before-mentioned; and when cloth with a pile, like plush or velvet, is wanted, it is to be woven in a velveteen loom, and then to be cut in the usual manner.

The directions in this specification should be taken with a little allowance, for if followed literally, for example, with regard to the carding, the destruction of the cards must be the consequence, as no cards fit for fur or wool could be strong enough to card flax or hemp, directed to be mixed with those materials.

In the composition for making the cloth waterproof, it should also be noted, that spirit of wine has no power to dissolve caoutchouc, as inferred by the patentee.

We shall just mention here that the parts of a loom commonly called lambs, as above, ought probably to be written lames, as being derived from the French language originally, in which that word signifies a blade, and from thence a thin flat piece of wood.

Patent granted to THOMAS HODGSON, *of William-street, Lambeth, Surrey, "Veterenarian," for improvements in the construction and manufacture of shoes, or substitutes for shoes, for horses and other cattle, and for methods for applying the same to the feet.* Dated October 7, 1824.

THE patentee commences his specification with laying down the proportions of the height of a horse's hoof to its breadth and length, stating also that the angle of inclination of its sloped part in front, and at the heel, is 30 degrees with the perpendicular. He also mentions that the hoofs of asses, and of other beasts, have the same angle of inclination likewise.

He then describes the shoe to which his patent relates as being made of an oval form, but larger in front, so as to fit the "*bulges*" of the hoof, while the narrow part of the oval (according to the sketch which is given of it), comes round the extremity of the frog. But it appears afterwards that the shoe is not to be left oval when finished, as it is directed to be cut open at the heel, and to be turned downward and outward at the hinder part, so as not to come in contact there with the hoof (as appears from another sketch), for about a third of its length. Its breadth and thickness are represented about the same as those of a common horse-shoe.

The bottom of the shoe is to be channelled, and cut rough like a rasp, to keep the horse from slipping; and to prevent this roughness wearing away too fast, the shoe is to be made somewhat concave, so as to press on the ground at the outside edge principally; and the hoof is to be pared a little concave at the back, to keep it from touching the shoe in that part till pressed down by the weight of the animal. The shoe will therefore only come in contact with the hoof in the front for about two-thirds of its length, and there it is to be fastened to it firmly by nails in the usual manner.

The patentee mentions that he is aware that shoes have been made somewhat of this shape before; but that this not having been done with reference to the proportions of the hoof, which he has laid down, he claims the method of doing so as his invention. He also states, that the same method of making shoes is applicable to those for other animals as well as for the horse.

The patentee not having given any explanation of the connexion between the proportions which he has so precisely laid down for the hoof of a horse, and the mode of forming the shoe with reference to it, we are entirely at a loss to conceive on what he founds his patent right.

Having, from circumstances, uninteresting to explain, seen frequently great numbers of hoofs in a prussian blue factory, we can answer for it that the variety of shape and form of hoofs is as great as can be conceived, consistent with the general character of the animal to which they belonged; and that any thing like mathematical precision on the subject is the last point we should have expected to see urged respecting them.

The appellation which the patentee has subjoined to his name, "*Veterenarian*," not being of regular authority as an English word, and its Latin original, *Veterenarius*, not being used by any classical author of note, has not been judicious; more particularly as the vanity of our gallic neighbours has caused their common blacksmiths to assume the title of *Artiste Veterenaire*, of which we can point out a conspicuous instance adjoining the Eglise de St. Sulpice, at the end of the Rue Ferou, Paris, where these words, in large letters, designate the forge of an ordinary horse-shoeing Vulcan.

If the idea we have formed of the meaning of the patentee be at all correct, the practice he recommends is admirably adapted to produce patients, that is, lame horses, for the exercise of the "Veterenarian's" skill in their cure, at least so far as the horses of Europe are concerned; and with those only are we intimately acquainted, though we have reason to believe that the horses of Asia may be somewhat different; that is, from having feet that are small, with the insensible covering very thick, very tough, and proportionally inelastic, they may be misused to a greater extent, without mischief being produced, than the general run of horses' feet in this country will bear. We know this to be the case with the Asiatic description of feet in this country, where, however, from the fancies of breeders, the mixtures of breeds, and various other causes, the varieties in feet are almost infinite.

Many years ago we saw the horses then at Astley's Amphitheatre, the ground surfaces of whose shoes were channelled, and cut rough like a rasp, to keep them from slipping. This, therefore, is not new; neither is the mode of making the shoe somewhat concave, so as to press on the ground at the outside edge principally (that is, if the surface of the ground was plane, and so hard as to be impenetrable). Nor is the mode recommended of having the shoe in contact with two-thirds of the hoof only, and that at the fore part, at all novel; it is the every-day practice of farriers, as one of the means adopted to make a lame horse useable, upon the simple and obvious principle of diminishing the pressure on a tender part, and increasing it on a healthy part. But this mode is not a prophilactic; although it will palliate the pain resulting from disease, it will not prevent disease taking place. Indeed, from giving the foot an unnatural bearing, from twisting and distorting it, a much more likely consequence is, the production of disease.

Patent granted to PHILIP TAYLOR, *of the City Road, Middlesex, Engineer, for improvements in steam-engines.* Dated July 3, 1824.

THE objects which this patent is intended to secure, are an arrangement of the piston rods of cylinders of steam-engines, when in an horizontal or inclined position, to prevent the pistons from pressing unequally on the cylinders, and a method of combining two or more cylinders so as to direct their joint powers to one operation.

The patentee directs, for attaining the first object, that the piston rod shall pass through the piston, and out through the opposite end of the horizontal or inclined cylinder, being provided with fit stuffing boxes at both of its extremities, and that each end of this long piston rod shall be furnished with a vertical wheel, grooved at its rim, and moving between two metal guides, parallel to each other, and to the sides of the cylinder. These guides being of course one above and the other below the wheels, would prevent the weight of the piston from making it press too much at the lower side of the cylinder, if the rod were perfectly inflexible; but as this cannot be, the patentee supposes that he will effect his purpose by causing considerable weights to act on each end of the rod in opposite directions, by appending them to the horizontal arms of "bell cranks" or bent levers, so as to tend to keep the rods straight by their being in a state of tension. These weights may either consist of pump rods at each extremity when the engine is employed in pumping the water from deep mines, or a pump rod may be at one extremity and the weight at the other, in which latter case the power of the engine exerted in lifting the weight would not be lost, as the weight would react on the piston rod in its descent, and assist the engine in lifting the pump rod and water at its opposite extremity.

It is obvious that these engines may be employed in producing rotary movements for mill work, as well as those of a reciprocating nature mentioned; but with the rotary movement the tension of the piston rod would not be effected, without weights being appended for this purpose to the bent levers at each of its extremities.

The action of two cylinders managed in this manner may be combined by placing them parallel to each other, and uniting their piston rods at each end to strong cross pieces, from the middle of which rods are to proceed to the bent levers, weighted as before. In the drawing two cylinders are represented, lying on the same horizontal plane, and having the wheels and guides at each end of the cross pieces, instead of being in the same line with the piston rod; but it is evident they may be placed one over the other also on the same principle, and that any number of them may be combined in this manner by properly disposing the cross pieces and wheels, which latter, however, need not be multiplied as the number of cylinders are increased, as the same number of wheels that will serve for the piston rods of two cylinders may also be made to support those of several more.

A method of binding these cylinders down firmly to their supports, whether the latter are constructed of stone or of cast-iron, is described by the patentee; as is also the mode of disposing the tubes that convey the steam to the several cylinders, and from them to the condenser, or to the open air (according to the nature of the engines), so as to make one set of valves or slides serve for them all. But as there is nothing particular in the arrangement of these tubes, or in the method of fastening down the cylinders, being such as may be easily conceived, they do not require further explanation.

We have made a few remarks relative to steam-engines with horizontal or inclined cylinders, in our account of the Operative Mechanic, by Mr. J. Nicholson, in p. 363 of this volume; and we are sorry to find that the great defect of engines of this description still remains without an effectual remedy, the plans of the patentee serving only for its diminution, but by no means for its total removal.

The support given by the wheels at each end of the prolonged piston rod evidently cannot prevent the weight of the piston from pressing on the lower side of the cylinder with a piston rod of the usual thickness; and if the piston rod be increased in size sufficiently to prevent its being bent by the weight of the piston, the power of the engine will be very much diminished by the great space which this bulky rod (or more properly mast) would occupy in the cylinder. Neither can the method of remedying the flexibility of this rod, by the tension given to it by great weights acting on bent levers at each of its extremities, be more effectual than the other, from the well-known vast power which a weight has when appended to the middle of any line, chain, or bar, in a horizontal position, to press it downwards a certain degree, as explained in most elementary treatises on dynamics of any eminence: and although the weights appended to the bent lever will react as mentioned, yet that will not prevent the loss of power which they will cause to the engine, in putting them in motion from a state of rest each time they are elevated, and that this loss will be large may be understood from considering how great these weights must be to give any effectual tension to the piston rod.

We shall farther observe of the first method, that if the pressure of the piston is attempted to be remedied by causing the wheels at the extremities of the rods to be pressed downwards by the upper guides, the same objections will exist as in the case first considered, with the addition that in this latter plan the great additional pressure which it will occasion on the lower sides of the stuffing boxes must tend to cut them open in that direction, as well as to wear out the lower sides of the piston rods.

We are not aware of any advantage that can arise from the other plan of the patentee, of combining several cylinders for one operation, at least in this country, where cylinders may be procured of any size. On the contrary, we think it would occasion loss of power, and great additional expense, as it is well known that the friction in cylinders is directly as their circumferences, while their powers are as the squares of their diameters, from which it must follow that the friction in four cylinders, for example, each of a foot diameter, would be twice as great as in one of two feet diameter, whose power would be equal to the whole of theirs, to say nothing of the greater friction which four piston rods must cause than one; and, moreover, not taking into account the loss of power that must arise from the greater space which the four piston rods will occupy in their respective cylinders, which even in low pressure engines cannot be less than in the proportion of ten pounds to the round inch of their transverse sections, and vastly more in high pressure engines.

Patent granted to Charles Phillips, *of Frindsbury, Kent, Esq. for improvements on tillers, and steering wheels of vessels of various denominations.* Dated July 13, 1824.

Two methods are described in the specification of this patent of communicating the action of the steering wheel to the rudder, and also a method of keeping the rudder steady and fixed in the position required, which is employed in conjunction with both the other plans.

In the first method of using the steering wheel, its roller, on which the cord is wound that gives motion to the tiller, turns round on an axis to which the steering wheel is attached; and to the further end of this roller a grooved wheel is fastened, in which a chain is fixed that acts on the tiller in all ordinary cases. On the end of the roller where it passes through this wheel, two pinions are placed at opposite sides of its diameter, which are attached to it by bolts that form axles, on which they turn, and which bolts also pass through a flat ring, placed at the other side of the pinions, opposite to the roller. On the axle that runs through the roller a third pinion is fixed, between the other two, whose teeth interlock with theirs, each of the three pinions being about a third of the diameter of the roller; and a ring, toothed at its internal surface, surrounds the three pinions, in which the two pinions attached to the roller work, and which, being screwed or bolted to the post or frame which supports the end of the axle of the roller, the consequence must be, that when the axle is turned round by the steering wheel, the pinion on its end will turn the two pinions fixed to the roller, which, pressing on the fixed toothed ring at their sides, will cause the roller to move round along with them with a force equal to the multiples of the circumference of the central pinion contained in that of the toothed ring, plus one circumference of the pinion, which latter addition this disposition of the pinions and ring occasions.

From the grooved wheel on the roller before-mentioned, the chain passes through blocks and over rollers, properly arranged for the purpose, to the end of a short tiller on the rudder (when the chain is used by itself); but when a rope is also attached to the roller for occasional use, then the chain is fastened on the tiller (which is of the usual length), nearer to the rudder than that part of it to which the rope is to be attached.

To prevent the chain from getting slack in certain positions of the rudder, the patentee directs the grooved wheel which works it to be made "eccentric," by which, and a proper position of its longer diameter, it will keep the chain equally tight at all times.

In the other method of moving the rudder, directed in the specification, a common steering wheel is used, from which the rope passes through blocks and over rollers, that direct its inflections to a horizontal wheel, placed with its centre directly over the gudgeons of the rudder, above the tiller, which in this case is made of iron, and is fixed to the top of an iron support that rises up from the *back* of the rudder, to which it is attached by being bent round at its lower end, and passing through to the front of the rudder head at that place.

From a point of the tiller, thus arranged, nearly over the centre of the rudder, a bar rises and bends off forwards at right angles, till it comes over the gudgeons of the rudder, and then rises up vertically again, where it forms the axle on which the horizontal wheel before-mentioned turns. There is reason to think, likewise, that the patentee intended that the lower end of this crank-shaped bar should turn also in the part of the tiller from whence it ascends. The front of the horizontal wheel projects beyond the tiller, and the end of this latter turns up at right angles, and enters into a cavity or groove cut for it through the wheel, of a particular shape, which may perhaps be conceived by supposing the groove to be parallel to the circumference for an eighth of its extent, at each side of the fore and aft diameter of the wheel; but when pretty near to this diameter, to incline inwards at each side, so as to meet at a point in the diameter nearer to the centre, in an angle of about 90°. The patentee asserts that this method of connecting the horizontal wheel with the tiller will add to it a great mechanical force.

The method of keeping the rudder steadily fixed when required, consists in having a horizontal wheel fixed at its top concentrically with its gudgeons, round the greatest portion of the outward edge of which wheel a band of iron passes, which is sustained in its place by flanches projecting from the wheel. One end of this iron band is fixed to the timber of the stern, and the other end to a lever near its centre of motion, which centre is a joint also fixed to the stern timbers: from the other end of this lever a rope is passed upwards, over pullies properly placed, to a ring close to the steering wheel; by pulling this rope the steersman can, from the action of the lever, cause the iron band to press on the edge of the wheel with great force.

In the second method described for giving motion to the rudder, this friction wheel is united to the horizontal wheel, which in it is fixed above the tiller, and forms with it one piece of the same circumference.

In the first described apparatus for moving the rudder, the small size of the pinions at the end of the roller of the steering wheel, as represented in the drawing, seems very ill calculated to give them the strength necessary for an operation, on which the safety of the ship so much depends. The method directed, of fastening them to the roller, is also very weak and imperfect.

The second plan described for the same purpose exhibits a curious instance of error. Because the bent end of the tiller will take some more time to be acted on by the wheel at each turn, on account of its having to traverse along a portion of the groove previously, from some confusion of ideas relative to the maxim in mechanics, that power gained is directly as the time expended, the patentee fancies that because the groove causes a *loss* of time it must gain power; when, in reality, the power of the wheel connected in this method by intermediate parts with the tiller, is in no respect greater than if it were actually fixed to it or to the rudder.

In the machinery which we have seen in some vessels for this purpose, the apparatus was so contrived as to rise along with the rudder, in case of its being lifted up in taking the ground, or in passing a bank, or by some sudden violent percussion from the waves in a storm, which preserved the machinery from injury at the time when it was most required. In the plans of the patentee there is no arrangement whatsoever for this object, and this omission alone would so far make them inferior to the methods already in practice.

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Persons desirous of obtaining Patents for inventions may have them procured with little trouble to themselves, and generally without their personal attendance in London, on application to the Proprietors of the Repertory, (addressed to Mr. Wyatt, Maiden Lane, Queen-street, Cheapside), who, from long practice and experience, presume they may be enabled to afford important assistance to Patentees in drawing up and adjusting their Specifications, on the accuracy and perspicuity of which, in a great measure, depends the security of the Patent.

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ERRATA.

Page 46, line 6, *for* raising great loads, frequently would, &c. *read*, raising great loads frequently, would, &c.

Page 56, lines 11 and 12 from the bottom, *for* will also have its limits, and the moving forward much quicker than the compressed air. Yet, &c. *read*, will also have its limits; and tho' moving forward much quicker than the compressed air, yet, &c.

Page 107, 12th line from top, *for* course of inaccuracy, *read*, source of inaccuracy.

Page 130, 20th line, *after* even, *insert*, be led.

Page 134, 8th line, *for* impressed, *read*, compressed.

Page 241, 3d line, *for* M. Sequin, *read*, M. Seguin.

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ADVERTISEMENT.

The design of this Work having been often very imperfectly understood from its late title, *The Repertory of Arts*, which has been frequently represented as not sufficiently explanatory of the precise nature of the publication; and it having been also in many instances confounded with other periodical works which have, since its establishment, appeared under a similar appellation, the Proprietors determined to commence a New or Third Series, and to adopt the variation in the original title that the reader will perceive they have prefixed to the present Volume; and at the same time to enlarge the plan of the Publication, by the introduction of an abridged account of Patents recently obtained, with occasional remarks upon their respective merits, which they believe has been considered an improvement of the Work, and rendered it more interesting. In the preparation of this part of the Work the utmost care will at all times be taken faithfully and correctly to describe the invention; and in the remarks, to be guided by the strictest impartiality—fair and just criticism being the point at which the Editors will most scrupulously aim; and they trust the specimen which the present Volume exhibits will prove their honest intentions.

The Proprietors beg leave also to observe, that the new type they have adopted has enabled them to give nearly eight pages, or half a sheet, of additional matter in every Number; and that they have farther increased each Number of the present Volume to the extent of another sheet, or sixteen pages; and they are gratified that the exertions and expense they have incurred to render the Work more deserving of the patronage of the Public, has been recompensed by an increased circulation.

With the view of rendering the Work still further useful to Inventors, the Proprietors have been induced to print, by way of Appendix, a concise Essay on the Law of Patents, a Work of which the Author, from his continued intercourse with Patentees for many years, as an Agent for obtaining Patents, has felt to be much wanted.

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A COMPENDIUM OF THE LAW OF PATENTS.

CHAPTER I.

Of Patents in general.

ALL grants from the Crown are made, not by deed or indenture, but by certain instruments called *letters patent*, or open writings, to which the great seal is affixed. In ancient times, when the Crown held large tracts of forest land and the estates of religious houses dissolved by Acts of Parliament, and was also in the continual acquisition of forfeited estates, these grants were very numerous, and were made upon various occasions. In modern times, besides patents of nobility, grants of offices, and charters to companies, they are most commonly applied to one single purpose, that of securing to an individual a monopoly in some new manufacture, or invention as it is more commonly termed, for a limited period, not exceeding fourteen years.

The first object of these patents is, in a general sense, universally understood; but there are some distinctions in the law concerning them, with which few persons are well acquainted; and the extreme caution which is necessary in the first procuring, or, as it is called, in soliciting them, is very little known, and therefore not always sufficiently observed. It has been said, indeed, by those best acquainted with the subject, that of the numerous patents obtained in the course of a year, not one-tenth could, if strictly examined, be sustained.

To persons wholly unacquainted with the subject, it might naturally appear, that the Royal authority having been once obtained for the monopoly of an invention, the proprietor must be thenceforth secured against all interruption in his enjoyment of it, during the term for which it is granted. There cannot, however, be a more erroneous opinion; for, in truth, the validity of a patent depends not upon the mere appendage of the *great seal*, or the authority of the Crown, of which it is the emblem, but on the nature of the manufacture itself, the conduct of the inventor or proprietor in obtaining the patent, and the correctness of the specification. Unless these be strict and regular in every part, the patent is of no avail, and the inventor has consumed his time, ingenuity, and labour, and wasted his money in vain. The author has upon many occasions found the parties for whom he has been employed to solicit patents, entirely unacquainted with the true extent of the authority or protection which they sought to obtain under the Royal grant, and completely uninformed of the requisites by which it was to be secured. In some instances this ignorance has led to fatal errors being committed before the author was consulted, which could not afterwards be remedied. He has therefore attempted to collect, in the following concise treatise, such plain and easy instructions as appear to him almost incapable of misapprehension, in order that persons seeking letters patent may be put upon their guard; and by informing them of the points to which in strictness they ought to direct their attention, not only to facilitate the obtaining of their patents, but to render such patents secure and valuable when obtained. In doing this, it has been his aim to avoid the compiling of an elaborate treatise. For he is convinced that simple and plain instructions are alone wanted; that the parade of learning would, on such an occasion, be an ostentatious and useless display, and that the end to be desired is not to set every inventor upon the conceit that he is equal to the soliciting of his own patent, but, on the contrary, that he should be warned of the technical difficulties which may occur, and see the necessity of obtaining proper advice from persons of experienced practice; and, above all, should be assisted in preparing a proper specification, that he may not, instead of a protection to the privilege which he claims, be deluded with a mere form, leaving an opening for others to step in and take the profits which his ingenuity has created, and his labours have matured.

CHAPTER II.

On the policy of granting Patents, and of publishing the Specifications.

THE wisdom of granting patents has been doubted by several enlightened men, among whom may be ranked as foremost the two late Chief Justices of the Court of King's Bench, Lords Kenyon and Ellenborough. An opinion is entertained by some persons that all inventions would come to light sooner or later, if no such protecting grant were made to their original authors.

It may be said, in answer, would Mr. WATT ever have brought the steam engine to that degree of practical perfection which it has now attained?

Would other important inventions have been completed, when the first attempt to bring them into notice has, in many instances, required an enormous disbursement, which the hope of the reward of an exclusive privilege could alone have induced the parties to have incurred?

The propriety of publishing the specifications of patents has also been much doubted. Lord Ellenborough has called the Repertory of Arts "a mischievous work, because it conveys a knowledge of the English inventions abroad." But, previous to the publication of the Repertory of Arts, foreigners used to visit this country purposely to inspect the rolls of specifications, and to transmit home copies of such as they deemed worthy of notice. The incorrectness, however, of the opinion that the publication of the specifications of patents is mischievous must be evident, when it is a well-known fact, capable of easy proof, that most of the important inventions now flourishing in the kingdom have originally taken their rise abroad, and thence been imported by industrious individuals, encouraged to such conduct by the admirable system of patents. This circumstance is alone, perhaps, an answer to those who have expressed an opinion against the propriety of such a mode of rewarding those who, by this means, add so much to the prosperity of our manufactures. Individuals may sometimes, it is admitted, be injured by the publication of their inventions, because hints taken from them may enable others to surpass and supersede the first contrivance; but this is a public good, and cannot be justifiably opposed by individual interests. It is, besides, a leading principle in the law of patents, and a condition in every patent, that the *specification* should give publicity to the inventor's secret.

Among the most prominent inventions and discoveries for which this country is indebted to foreigners, may be mentioned, the new system of bleaching and tanning; the machinery for making paper in large sheets; and the invention of manufacturing paper from straw; and, above all, the very ingenious and important machinery erected in the King's Dockyards at Portsmouth and Chatham, for making ships' blocks. It is also a fact, that foreigners, particularly

Americans, are arriving constantly with important inventions; and by a reference to the list of patents, published monthly in the Repertory of Arts, it may be seen that those now granted for inventions communicated by foreigners, are nearly as numerous as those for inventions of native growth. If it is improper to publish specifications, it must be equally bad policy for the Royal Society, and other eminent scientific institutions, to publish their proceedings, which are very often the foundation on which patent inventions have been subsequently created. But no person will surely be bold enough to support such an opinion in opposition to the universal practice of all the scientific societies of Europe, who publish their proceedings in order to accelerate the general diffusion of knowledge, to which valuable purpose the Repertory of Arts may be said, with safety, to add in no inconsiderable degree.

CHAPTER III.

On the form and course of granting Patents.

By statute 27 Henry VIII. chapter 9, in order to settle the fees of the King's offices upon the granting of patents, it is enacted, that every gift or grant of the King, signed with his sign manual, to be passed the great seal of England, Ireland, and the Duchy of Lancaster in the principality of Wales, shall be brought to the principal secretary, or one of the clerks of the King's signet, to be passed. One of the clerks of the signet, to whom the same shall come, shall, by warrant of the same bill, within eight days after, unless the King's pleasure to the contrary is signified, make warrants to the Lord Keeper of the privy seal for the same; and one of the clerks of the privy seal, upon due examination by the Lord Keeper thereof, shall in eight days after, unless commanded to the contrary, make a warrant with the name of the clerk to the privy seal, to the Lord Chancellor, or Keeper of the great seal, &c. for the writing and sealing thereof with the great seal.

The proceedings are now usually in the following order.

First.—An affidavit is made by the inventor, declaring that he has invented or discovered something which he specifically describes, and that he is the first and true inventor thereof.

Secondly.—A petition, praying for letters patent to be granted for the said invention or discovery, is prepared.

Thirdly.—The petition is referred by the Secretary of State for the Home Department to the Attorney or Solicitor General.

Fourthly.—The Attorney or Solicitor General makes a report thereon.

Fifthly.—A warrant for the bill, signed by the Sovereign, is issued to the Attorney or Solicitor General.

Sixthly.—The Attorney or Solicitor General prepares and signs a bill for the patent, which is also signed by the Sovereign.

Seventhly.—The bill, and transcript thereof, are transmitted to one of the clerks of the signet and Lord Privy Seal.

Eighthly.—The patent receives the great seal, and, in consequence of the proviso or condition contained therein,

Ninthly.—A description of the invention is enrolled in the Court of Chancery, which is called the specification.

Were this designed as a book of practice for the profession, it would be necessary to give particular directions for the proceedings in all these respects; but it being intended only to assist the inventor in his application for a patent, with the aid of some person already acquainted with the formal practice, the material points which demand his particular attention will alone be noticed; these are, the *caveat*, the *petition* and *affidavit* in support thereof, and the *specification*.

CHAPTER IV.

Of the Caveat.

THIS is merely a memorandum or notice left at certain offices, through which every patent must pass, describing the nature of the invention, and requesting that no patent for that purpose be allowed to pass without notice to the persons described in this memorandum or notice, and which is denominated a *caveat*.

The nature and effect of a caveat is very little understood, or rather much misunderstood. Many inventions have been pirated from the original inventors through their confident reliance on the supposed security which the caveat afforded. It has been very frequently supposed that a caveat would secure the sole right to an invention in the same manner, during the period for which it was entered, as though a patent had been obtained; that it would enable the party to practise the invention with security during the time in which he might be employed in bringing it to maturity or ascertaining its value; and that in consequence of having entered a caveat, no person could obtain a patent for the invention which the party claimed, nor even practise it; but that the party who had entered the caveat would secure the right to his patent whenever he should think proper to apply for it. In short, that it was to all intents and purposes a patent for a year (being the period for which it remains in force), and renewable from year to year.

This erroneous confidence in the power and effect of a caveat has been very frequently the cause of much injury to inventors; and it is truly astonishing how so erroneous an opinion should ever have been promulgated, though it is, perhaps, still more surprising that the prevalence of the opinion should be so very general as it has been found to be.

The author of this tract has indeed, in the course of his experience, found it to be an error almost universally prevalent; and it is much to be desired that inventors should be properly warned against the frauds to which they may be exposed by thus mistaking the true effect of a caveat.

A caveat, instead of being a security, is, on the contrary, but of little use; and in some instances it is advisable not to enter a caveat at all. When entered, it should be drawn up in very general terms, lest the invention should be pirated by some designing persons, to whom the caveat book may be submitted for inspection, which, for a trifling fee, may be examined by any one.

The fear of piracy in this way is by no means chimerical. The author has himself known several instances, in which advantage had actually been taken to pirate an invention, through the information to which the party was led by means of the caveat.

The universal prevalence of entering caveats has probably arisen from the direction given in the "*Book of Costs*," that upon applying for a patent in the first instance, the party must enter a caveat at the offices of the Attorney and Solicitor Generals, and also at the office of the Great Seal. This is often improper advice, and frequently of no other use than to add unnecessarily to the expence of obtaining a patent.

The Attorney or Solicitor General, upon every application for a patent, is referred to, by the Secretary of State, for his advice whether it is fit that the patent should be granted; and a caveat is merely a doquet or request that these officers should give the party notice of any petition for a patent for any invention similar to the one intended to be protected. If, upon notice of an application for a patent for a similar invention, the party thinks it probable that it will interfere with the one for which he has entered a caveat, he gives notice of his intention to oppose the patent, and all parties are consequently summoned before the Attorney or Solicitor General, in order that each may explain privately, and in confidence to him, the merits of their respective claims. It sometimes happens, however, that the parties, although they live at a distance from each other, and evidently have never had any communication, the one with the other, may, notwithstanding, have accidentally hit on the same contrivance or invention. In that case it was formerly the practice to proceed to an examination to ascertain the actual priority of the invention; but it is now customary to recommend the parties to join their interests, by taking out a patent in conjunction, or otherwise to arrange matters so that they shall not become competitors. The reason given for this com-promise proves the correctness of the preceding remarks to the full extent, as to the mistaken notion of the effect of a caveat. Each party being in possession of the other's secret, it is in the power of either, should the Attorney or Solicitor General award the patent to his opponent, to make the invention public before a patent can be completed, that is to say, before it can receive the Great Seal, in which case the patent would be invalid, and the invention become public property. Enough, perhaps, has been said to explain the nature of a caveat, and it will be requisite only to point out the cases where a caveat is of real utility.

It is desirable that a caveat should be entered when the party cannot readily determine on the prudence of obtaining a patent, either because it may not suit his pecuniary means, or because he must, for various reasons, communicate his secret to other persons; such, for instance, as workmen or others, whose assistance or advice he may require. In either of these instances a caveat may very properly be entered, as it will prevent all such persons from fraudulently and surreptitiously obtaining a patent for the invention which may have been communicated to them in confidence. But it must be recollected, that a caveat will not prevent these persons from publishing the invention, and thereby precluding the real inventor from obtaining a valid patent. For these reasons it is always desirable to apply for a patent with as little delay as prudence in other respects will permit; and, if it can possibly be avoided, not to make any person acquainted with the nature of the invention previously to the patent having passed the Great Seal.

It is proper to enter a caveat on applying for a patent, to prevent other persons from running a race with the inventor to the Great Seal, and obtaining a patent before him for the same invention. This may be considered very probable, where the petition is for a patent for the importation from a foreign country.

The first application for a patent may, from various causes, be delayed, while another person may, in the mean while, receive the communication, and also apply for a patent. Under such circumstances, the present Chancellor, Lord Eldon, in the case, "ex parte Dyer," held, "that he could see no other mode of deciding than by awarding the patent to him that ran quickest."

When a patent has been obtained, it has been considered a good practice to continue caveats during the whole term of the patent, in order that no application may be made for any similar invention, without the knowledge of the first patentee, and that he may prevent the grant of a patent for an invention infringing on his own, which might happen from the ignorance of the parties. This practice of continuing a caveat by a patentee is to be recommended, as frequently preventing an infringement at little expence, and without endangering the original patent, which is liable to severe scrutiny in a court of justice, if an action be brought for an infringement on a patent. It can then only be sustained when it is perfect in all respects.

The late Lord Chief Justice, Lord Ellenborough, when Attorney General, stopped several patents, on the ground of interfering with other patents. It must, however, be a very obvious infringement to induce the Attorney or Solicitor General to take upon himself to decide in this way, as the parties have their remedy at law, and the benefit of a jury to decide, before whom competent witnesses can be examined. On the contrary, the time of the Attorney and Solicitor Generals is too much occupied by their various and important duties, to permit them examining witnesses at much length; and generally not being well versed in chemistry or mechanics, they are inclined to avoid giving a decision in a case of much nicety. It sometimes happens that the decision of the Attorney or Solicitor General is unsatisfactory to the parties, or that persons interested in, or claiming a right to, the invention, were not in time to oppose the patent in such stage of its progress. In that case it is usual to enter a caveat at the Great Seal; but this may be considered, even in point of expence, a bad practice, for the Chancellor has mostly decided that the patent, after having passed so far as the Great Seal, shall not be then stopped. This used to be the universal practice of the Court of Chancery; and Lord Eldon has, in addition, usually awarded that the costs of the application to the Court to remove the caveat be paid by the party entering the caveat, which formerly were invariably borne by each party, that is, each party paid his own costs. The effect of this practice was, that a patent might be maliciously delayed for many weeks, and sometimes months, to the great and irreparable injury of the patentee, at the mere trifling expence of the caveat at the Great Seal. But by the present practice it is otherwise; for by fear of incurring the costs, a great deal of groundless litigation is avoided.

The following is the form of a caveat:—viz.

CAVEAT against granting a patent to any person or persons for [*Here insert the title or object of the invention intended to be protected.*] without notice to A. B. of &c. &c.

CHAPTER V.

Of the Affidavit and Petition.

The affidavit and petition are of more importance than is usually supposed, as all the proceedings for the patent are grounded on them. Great care, therefore, ought to be taken that the invention is accurately described in them. If the title given to the invention in the affidavit should not be correct, the patent itself will be faulty, and rendered voidable.

In preparing the affidavit, attention ought to be paid to the specification that is to follow as one of the conditions of the patent, and in which great care and nicety are required to make it complete, so as to ensure the validity of the patent.

The title given to the invention in the affidavit ought to be well considered, that it may correctly designate the invention for which the patent is desired; that it should be neither more nor less comprehensive than the facts warrant; that it should not describe the invention as a matter entirely new, when it is merely an improvement; that it should not be confined to one method when there are several methods to be stated; and so on the contrary.

If two modes have been invented for accomplishing one object, and are described in the specification, and the patent has been obtained for only one, under the title of a *method,* it will be a fatal defect in the patent; and so on the contrary; for the law apprehends fraud in such cases, and consequently inflicts a severe penalty. It is therefore necessary to be aware, in preparing the affidavit, that the title therein given to the invention will be exactly the same in the patent, with which the specification also must agree. This, though in fact a separate instrument, should therefore, in some respects, be considered as one and the same, or as a continuation or repetition of the same. A want of attention to this point is ordinarily the cause of so many patents being invalid. The insecurity of patents is by the inconsiderate too frequently imputed to a defect in the law, which, perhaps, with one exception only, could not be improved. Did they attend properly to the forms prescribed, and take out their patents properly, they would be in most cases safe.

Many patents now in force might be set aside from the incorrectness of their titles. The affidavit should not be too particular or minute in describing the invention, because in the passing of the patent through the offices, the title may be seen by some one who may learn from it the nature of the invention, and thereby take advantage of it, as observed in the case of the caveat.

The following is the form of the affidavit, which must be written on an affidavit stamp (value 2*s.* 6*d.*), and sworn before a Master, or, if in the country, a Master Extraordinary, in Chancery.

A. B. of ———, maketh oath and saith, that after much study and expense he hath invented (*Here insert the precise title of the invention*). That he is the first and true inventor thereof, and that the said invention is entirely new, and has never been practised or used by any other person or persons, to the best of his knowledge and belief.

Signed A. B.

SWORN at ——, this —— day of ——,
Before me, C. D.

The following is the form of the Petition.

To the King's Most Excellent Majesty.

The humble Petition of A. B. of

SHEWETH, That your Petitioner hath, after much study and expense, invented (*Here insert the title or object of the invention for which letters patent are required*), which invention he believes will be of great public utility. That he is the true and first inventor thereof, and that the said invention hath not been practised or used by any other person or persons whatsoever, to the best of his knowledge and belief.

Your Petitioner therefore humbly prays your Majesty will be graciously pleased to grant unto him, his executors, administrators, and assigns, your Majesty's Royal Letters Patent, under the Great Seal of your Majesty's United Kingdom of Great Britain and Ireland, for the sole use, benefit, and advantage of his said invention, within that part of your Majesty's United Kingdom of Great Britain and Ireland called England, your dominion of Wales, and town of Berwick-upon-Tweed, for the term of fourteen years, pursuant to the statute in that case made and provided.

And your petitioner will ever pray, &c.

When it is desired that the patent shall extend to the Colonies, the words "*and in all your Majesty's Colonies and Plantations abroad*" should be introduced after the word "*Tweed.*" A Patent for England does not extend to Scotland or Ireland, for each of which separate patents must be obtained.

CHAPTER VI.

Of the Specification.

When patents were first granted it was not required of the patentee to enrol any description of the invention; but the Attorney and Solicitor Generals, who have the power of imposing any conditions on the patentee they may judge proper, considering that the practice which had arisen subsequently, of inserting a long account of the invention in the patent itself, was either very imperfect or very inconvenient, expensive, and also very unsafe for the inventor, as his invention might be pirated and made public before his patent had passed the Great Seal, directed that a full and particular description of the nature of the invention, and the manner in which it was to be performed, should be enrolled in Chancery within a certain period from the completion of the patent, otherwise the patent should be void. This period has been varied, according to the judgment of the Attorney and Solicitor General for the time being. It was at one time four months; then it was changed to one; and at present it is fixed, in ordinary cases, at two months; but longer time may be obtained, if necessary, upon a proper suggestion to the Attorney or Solicitor General, previously to his making the report in favour of the patent; and in the case of applying for a patent also for Scotland, four months are granted; and when a patent for Ireland is likewise solicited, six months are allowed.

The greatest possible care and accuracy is requisite in preparing this instrument, and if it is in any respect defective it will vitiate the patent. This subject will come again under consideration in treating of the law of patents, from which a sufficient knowledge of what is requisite in the specification may, for all practical purposes, be obtained. Any other mode of explaining it might tend to mislead all parties; but the chief object of it is to describe the invention, that after the expiration of the patent any person of ordinary skill upon the subject may be enabled to prepare and use the invention.

CHAPTER VII.

Summary of the Law of Patents.

By the common law of England, which is principally the natural law of reason, all trade and manufacture is to be considered as perfectly free, and nothing can be more odious than the principle or practice of monopoly.

In times of feudal policy, when the soil and property of the whole nation were considered as held of an arbitrary Monarch, who could portion out what part he pleased among his favourites, it was, however, not unusual to grant monopolies by letters patent, which have been subsequently restrained by the statute, 21 James I. c. 3.

It was the object of this statute to annul and destroy all monopolies whatsoever, the granting of which had then lately been carried to a very mischievous extent; but as it was considered a great encouragement to the improvement of trade and manufacture, that all who contribute to that desirable end should have an exclusive property in their new discoveries, or new manufactures, an exception was introduced into the statute, by a proviso, in favour of letters patent to be granted for the sole working or making of new manufactures, to be granted to the true inventors thereof for fourteen years.

It is, therefore, upon the effect of this proviso alone, that all the authority of any patent depends. Whatever is not within the words and obvious meaning of this exception in the statute, is not only invalid, but absolutely illegal, and any person aggrieved thereby is entitled to recover treble damages and cost, under section 4 of the same statute. In order to state the law clearly upon the subject, it will therefore be first necessary to set forth the principal clauses of the statute, and to add, by way of comment on the principal and operative words in it, such cases as have occurred, and such an exposition of its operation as is consistent with the train of the decisions upon the subject.

Statute of Monopolies.

21 JAMES I, c. 3.

Intituled, an Act concerning Monopolies and Dispensations, with Patent Laws, and Forfeitures thereof.

I. *For as much* as your Most Excellent Majesty, in your royal judgment and of your blessed disposition to the weal and quiet of your subjects, did, in the year of our Lord God one thousand six hundred and ten, publish in print to the whole realm, and to all posterity, that all grants and monopolies, and of the benefit of any penal laws, or of power to dispense with the law, or to compound for the forfeiture, are contrary to your Majesty's laws, which your Majesty's declaration is truly consonant and agreeable to the ancient and fundamental laws of this realm: And whereas your Majesty was further graciously pleased expressly to command, that no suiter should presume to move your Majesty for matters of that nature; yet, nevertheless, upon misinformation and untrue pretences of public good, many such grants have been unduly obtained and unlawfully put in execution, to the great grievance and inconvenience of your Majesty's subjects, contrary to the laws of this your realm, and contrary to your Majesty's most royal and blessed intention, so published as aforesaid. For avoiding whereof and preventing the like in time to come, may it please your excellent Majesty, at the humble suit of the Lords spiritual and temporal, and the Commons, in this present Parliament assembled, that it may be declared and enacted by this present Parliament, that all monopolies, and all commissions, grants, licences, charters, and *letters patent, heretofore made or granted to any person or persons, bodies politic or corporate, whatsoever, or for the sole buying, selling, making, working, or using of any thing within this realm,* or the dominion of Wales, or of any other monopolies, or of power, liberty, or faculty to dispense with any others, or to give licence or toleration to do, use, or exercise any thing against the tenor or purport of any law or statute, or to give or make any warrant for any such dispensation, licence, or toleration to be had or made; or to agree or compound with any others for any penalty or forfeitures limited by any statute; or of any grant or promise of the benefit, profit, or commodity of any forfeiture, penalty, or sum of money that is or shall be due by any statute, before judgment thereupon had; and whatsoever any way tending to the instituting, erecting, strengthening, furthering, or countenancing of the same, or any of them, are altogether contrary to the laws of this realm, and so are and shall *be utterly void and of none effect;* and in no wise to be put in use or execution.

II. And be it further declared and enacted, by the authority aforesaid, that all monopolies, and all such commissions, grants, licences, charters, letters patent, proclamations, inhibitions, restraints, warrants of assistance, and all other matters and things tending as aforesaid, and the force and validity of them and of every of them, ought to be and shall be for ever hereafter examined, heard, tried, and determined, by and according to the common laws of this realm, and not otherwise.

III. And be it further enacted, by the authority aforesaid, that all person or persons, bodies politic and corporate, whatsoever, which now are or hereafter shall be, shall stand and be disabled and uncapable to have, use, exercise, or put in use, any monopoly, or any such commission, grant, licence, charter, letters patent, proclamation, inhibition, restraint, warrant of assistance, or other matter or thing tending as aforesaid, or any liberty, power, or faculty, grounded or pretended to be grounded on them, or any of them.

IV. And be it further enacted, by the authority aforesaid, that if any person or persons, at any time after the end of forty days next after the end of this present Session of Parliament, shall be hindered, grieved, disturbed, or disquieted, or his or their goods or chattels any way seized, attacked, distrained, taken, carried away, or detained, by occasion or pretext of any monopoly, or of any such commission, grant, licence, power, liberty, faculty, letters patent, proclamation, inhibition, restraint, warrant of assistance, or other matter or thing tending as aforesaid, and will sue to be relieved in or for any of the premises; that then, and in every such case, the same person or persons shall and may have his and their remedy for the same at the common law, by any action or actions to be grounded upon this statute, the same action or actions to be heard and determined in the Courts of King's Bench, Common Pleas, and Exchequer, or in any of them, against him or them, by whom he or they shall be so hindered, grieved, disturbed, or disquieted, or against him or them by whom his or their goods or chattels shall be so seized, attacked, or distrained, taken, carried away, or detained, wherein all and every such person or persons which shall be so hindered, grieved, disturbed, or disquieted, or whose goods or chattels shall be so seized, attacked, distrained, taken, carried away, or detained, shall recover three times so much as the damages which he or they sustained by means or occasion of being so hindered, grieved, disturbed, or disquieted, or by means of having his or their goods or chattels seized, attacked, distrained, taken, carried away, or detained, and double costs; and in such suits, or for the staying or delaying thereof, no essoin, protection, wager of law, aid, prayer, privilege, injunction, or order of restraint, shall be in any wise prayed, granted, admitted, or allowed, nor any more than one imparlance. And if any person or persons shall, after notice given that the action depending is grounded upon this statute, cause or procure any action at the common law, grounded upon this statute, to be stayed or delayed before judgment, by colour or means of any order, warrant, power, or authority, save only of the Court wherein such actions as aforesaid shall be brought and depending, or after judgment had upon such action shall cause or procure the execution of or upon any such judgment to be stayed or delayed, by colour or means of any such order, warrant, power, or authority, save only by writ of error or attaint; that then the said person or persons so offending shall incur and sustain the pains, penalties, and forfeitures, ordained and provided by the statute of provision and præmunire, made in the sixteenth year of the reign of King Richard the Second.

V. Provided nevertheless, and be it declared and enacted, that any declaration before-mentioned shall not extend to any letters patents, grants of privilege for the term of one-and-twenty years or under, heretofore made, of the sole working or making of any manner of new manufacture within this realm, to the first and true inventor or inventors of such manufactures, which others at the time of making such letters patent and grants did not use, so they be not contrary to the law nor mischievous to the state, by rising the prices of commodities at home, or hurt to trade, or generally inconvenient, but that the same shall be of such force as they were or should be if this act had not been made, and of none other; and if the same were made for more than one-and-twenty years, that then the same, for the term of one-and-twenty years only, to be accounted from the date of the first letters patent and grants thereof made, shall be of such force as they were or should have been if the same had been made but for the term of one-and-twenty years only, and as if this act had never been made or had, and none other.

VI. Provided also, and be it declared and enacted, that any declaration before-mentioned shall not extend to any letters patents and grants of *privilege for the term of fourteen years or under, hereafter to be made, of the sole working or making of any manner of new manufactures, which others, at the time of making such letters patent and grants, shall not use, so as also they be not contrary to the law, nor mischievous to the state, by raising of prices of commodities at home, or hurt of trade, or generally inconvenient;* the said fourteen years to be accounted from the date of the first letters patents, or grants of such privilege hereafter to be made, but that the same shall be of such force as they should be if this act had never been made, and of none other.

VII. Provided also, and it is hereby further intended, declared, and enacted, by authority aforesaid, that this act, or any thing therein contained, shall not in any wise extend or be prejudicial to any grant or privilege, power or authority, whatsoever, heretofore made, granted, allowed, and confirmed, by any Act of Parliament now in force, so long as the same shall continue in force.

VIII. Provided also, that this act shall not extend to any warrant or privy seal, made or directed, or to be made or directed by his Majesty, his heirs, or successors, to the Justices of the Courts of the King's Bench or Common Pleas, and Barons of the Exchequer, Justices of Assize, Justices of Oyer and Terminer and Gaol-delivery, Justices of the Peace, and other Justices for the time being, having power to hear and determine offences done against any penal statute depending in suit and question before them, or any of them respectively, after plea pleaded by the party defendant.

IX. Provided also, and it is hereby further intended, declared, and enacted, that this act, or any thing therein contained, shall not in any wise extend or be prejudicial unto the city of London, or to any city, borough, or town corporate within this realm, for or concerning any grants, charters, or letters patents, to them or any of them; or unto any corporations, companies, or fellowships of any art, trade, occupation, or mystery, or to any companies or societies of merchants within this realm, erected for the maintenance, enlargement, or ordering of any trade of merchandise; but that the same charters, customs, corporations, companies, fellowships and societies, and their liberties, privileges, powers, and immunities, shall be and continue of such force and effect as they were before the making of this act, and of none other; any thing before in this act contained to the contrary in any wise, notwithstanding.

X. Provided also, and be it enacted, that this act, or any declaration, provision, disablement, penalty, forfeiture, or other thing before-mentioned, shall not extend to any letters patents of grants of privilege heretofore made or hereafter to be made of, for, or concerning the digging, making, or compounding of saltpetre, or gunpowder, or the casting or making of ordnance, or shot for ordnance, nor to any grant or letters patents heretofore made, or hereafter to be made, of any office or offices heretofore erected, made, or ordained, now in being, and put in execution, other than such offices as have been decried by any His Majesty's proclamation or proclamations; but that all and every the same grants, commissions, and letters patents, and all other matters and things tending to the maintaining, strengthening, and furtherance of the same, or any of them, shall be and remain of the like force and effect, and no other, and as free from the declarations, provisions, penalties, and forfeitures contained in this act, as if this act had never been had nor made, and not otherwise.

XI. Provided also, and be it enacted, that this act, or any declaration, provision, disablement, penalty, forfeiture, or other thing before-mentioned, shall not extend to any commission, grant, letters patents, or privilege heretofore made, or hereafter to be made, of, for, or concerning the digging, compounding, or making of alum, or alum-mines; but that all and every the same commissions, grants, letters patents, and privileges, shall be and remain of the like force and effect, and no other, and as free from the declarations, provisions, penalties, and forfeitures contained in this act, as if the act had never been had nor made, and not otherwise.

XII. Provided also, and be it enacted, that this act, or any declaration, provision, penalty, forfeiture, or other thing before-mentioned, shall not extend or be prejudicial to any use, custom, prescription, franchise, freedom, jurisdiction, immunity, liberty, or privilege heretofore claimed, used, or enjoyed by the governors and stewards and brethren of the fellowship of the hoast-men of the town of Newcastle-upon-Tyne, or by the ancient fellowship, gild, or fraternity, commonly called hoast-men, for or concerning the selling, carrying, lading, disposing, shipping, venting, or trading of or for any sea coals, stone coals, or pit coals, forth or out of the haven or river of Tyne, or to any grant made by the said governor and stewards and brethren of the fellowship of the said hoast-men to the late Queen Elizabeth, of any duty or sum of money to be paid for, or in respect of any such coals as aforesaid; nor to any grants, letters patents, or commission, heretofore granted, or hereafter to be granted, of, for, or concerning the licensing of the keeping of any tavern or taverns; or selling, uttering, or retailing of wines to be drunk or spent in the mansion-house, or houses, or other place in the tenure or occupation of the party or parties so selling or uttering the same; or for or concerning the making of any compositions for such licences, so as the benefit of such compositions be reserved and applied to and for the use of his Majesty, his heirs, or successors, and not to the private use of any person or persons.

XIII. Provided also, and be it enacted, that this act, or any declaration, provision, penalty, forfeiture, or other thing before-mentioned, shall not exend or be prejudicial to a grant or privilege for or concerning the making of glass, by his Majesty's letters patents under the great seal of England, bearing date the two-and-twentieth day of May, in the one-and-twentieth year of his Majesty's reign of England, made and granted to Sir Robert Mansel, Knight, Vice Admiral of England: nor to a grant or letters patents, bearing date the twelfth of June, in the thirteenth year of his Majesty's reign of England, made to James Maxewell, Esquire, concerning the transportation of calves skins: but that the said several letters patents, last mentioned, shall be and remain of the like force and effect, and as free from the declarations, provisions, penalties, and forfeitures before-mentioned, as if this act had never been had nor made, and not otherwise.

XIV. Provided also, and be it declared and enacted, that this act, or any declaration, provision, penalty, forfeiture, or other thing before-mentioned, shall not extend or be prejudicial to a grant or privilege for or concerning the making of smalt, by his Majesty's letters patents, under the great seal of England, bearing date the sixteenth day of February, in the sixteenth year of his Majesty's reign of England, made or granted to Abraham Baker; nor to a grant or privilege for or concerning the melting of iron ewer, and of making the same into cast-works or bars with sea coals or pit coals, by his Majesty's letters patents, under the great seal of England, bearing date the twentieth day of February, in the nineteenth year of his Majesty's reign of England, made or granted to Edward, Lord Dudley; but that the same several letters patents and grants shall be and remain of the like force and effect, and as free from the declarations, provisions, penalties, and forfeitures before-mentioned, as if this act had never been had nor made, and not otherwise.

The patent contains certain terms and restrictions which it has been found beneficial for the public to introduce; and as these must also be considered in ascertaining the effect and validity of a patent, we shall next insert the usual form now adopted. It is material that every patentee should carefully peruse and consider the claims and conditions of the patent, in order that he may clearly understand the terms upon which the grant has been made.

The form of Letters Patent for Inventions.

GEORGE, R.

George the Fourth, by the Grace of God, &c.— To all to whom these presents shall come greeting. Whereas A. B. of   in the county of   hath by his petition humbly represented unto us that he hath, after much study and expence, invented *certain improvements in steam-engines*, which the petitioner conceives will be of great public utility; that he is *the first and true inventor thereof*, and that the same has not been practised or used by any other person or persons, to the best of his knowledge and belief. The petitioner therefore most humbly prayed that we would be graciously pleased to grant unto him, his executors, administrators and assigns, our royal letters patent, under the great seal of our united kingdom of Great Britain and Ireland, for the sole use, benefit, and advantage of his said invention, within that part of our united kingdom of Great Britain and Ireland, called England, our dominion of Wales, and town of Berwick-upon-Tweed, and also within all our Colonies and Plantations abroad,* for the term of fourteen years, pursuant to the statute in that case made and provided; and we being willing to give encouragement to all arts and inventions which may be for the public good, are graciously pleased to condescend to the petitioner's request, *Know ye therefore, that we, of our especial grace, certain knowledge and mere motion, have given and granted, and by these presents for us, our heirs, and successors, Do give and grant unto the said A. B.* his executors, administrators and assigns, our especial licence, full power, sole privilege and authority, that he the said A. B. his executors, administrators and assigns, and every of them by himself and themselves, or by his or their deputy or deputies, servants or agents, or such others as he the said A. B. his executors, administrators and assigns, shall at any time agree with, and no others, from time to time, and at all times hereafter, during the term of years herein expressed, shall and lawfully may make use of, exercise, and vend his said invention within that part of our united kingdom of Great Britain and Ireland, called England, our dominion of Wales, and town of Berwick-upon-Tweed, in such manner as to him the said A. B. his executors, administrators and assigns, or any of them, shall in his or their discretions seem meet. And that he the said A. B. his executors, administrators and assigns, shall and lawfully may have and enjoy the whole profit, benefit, commodity and advantage from time to time coming, growing, accruing and arising by reason of the said invention, for and during the term of years herein mentioned, to have, hold, exercise, and enjoy the said licence, powers, privileges, and advantages hereinbefore granted or mentioned to be granted unto the said A. B. his executors, administrators and assigns, for and during, and unto the full end and *term of fourteen years, from the* DATE *of these presents next and immediately ensuing, and fully to be complete and ended according to the statute in such case made and provided.* And to the end that he the said A. B. his executors, administrators and assigns, and every of them, may have and enjoy the full benefit and the sole use and exercise of the said invention, according to our gracious intention hereinbefore declared, We do by these presents, for us and our heirs and successors, require and strictly command all and every person and persons, bodies politic and corporate, and all other our subjects whatsoever, of what estate, quality, degree, name, or condition soever they be, within that said part of our united kingdom of Great Britain and Ireland, called England, our dominion of Wales, and town of Berwick-upon-Tweed aforesaid, that neither they, nor any of them, at any time during the continuance of the said term of fourteen years hereby granted, either directly or indirectly, do make use or put in practice the said invention, or any part of the same so attained unto by the said A. B. as aforesaid, nor in any wise counterfeit, imitate, or resemble the same, nor shall make, or cause to be made, any addition thereunto, or subtraction from the same, whereby to pretend himself or themselves the inventor or inventors, devisor or devisors thereof, without the licence, consent, or agreement of the said A. B. his executors, administrators and assigns, in writing, under his or their hands and seals, first had and obtained in that behalf, upon such pains and penalties as can or may be justly inflicted on such offenders for their contempt of this our royal command; and further, to be answerable to the said A. B. his executors, administrators and assigns, according to law, for his and their damages thereby occasioned. And moreover, We do by these presents, for us, our heirs and successors, will and command all and singular the justices of the peace, mayors, sheriffs, bailiffs, constables, head boroughs, and all other officers and ministers whatsoever of us, our heirs and successors for the time being, that they or any of them do not, nor shall at any time hereafter during the said term hereby granted, in any wise molest, trouble, or hinder the said A. B. his executors, administrators and assigns, or any of them, or his or their deputies, servants or agents, in or about the due and lawful use or exercise of the aforesaid invention, or any thing relating thereto; provided always, and these our letters patent are and shall be upon this condition, that if at any time during the said term hereby granted, it shall be made appear to us, our heirs or successors, or any six or more of our or their privy council, that this our grant is contrary to law, or prejudicial, or inconvenient to our subjects in general, or that the said invention is not a new invention, as to the public use and exercise thereof in that said part of our united kingdom of Great Britain and Ireland, called England, our dominion of Wales, and town of Berwick-upon-Tweed aforesaid, *or not invented and found out by the said A. B. aforesaid, then upon signification or declaration thereof, to be made by us, our heirs and successors, under our or their signet or privy seal, and by the lords of our or their privy council, or any six or more of them under their hands, these our letters patent shall forthwith cease, determine, and be utterly void, to all intents and purposes, any thing hereinbefore contained to the contrary thereof, in any wise notwithstanding.* Provided also, that these our letters patent, or any thing herein contained, shall not extend, or be construed to extend, to give privilege unto the said A. B. his executors, administrators or assigns, or any of them, to use or imitate any invention or work whatsoever, which *has heretofore been found out or invented by any* other of our subjects whatsoever, and publicly used or exercised in that said part of our united kingdom of Great Britain and Ireland, called England, our dominion of Wales, or town of Berwick-upon-Tweed, unto whom like letters patent or privileges have been already granted for the sole use, benefit, and exercise thereof; it being our will and pleasure that the said A. B. his executors, administrators and assigns, and all and every other person or persons to whom like letters patent or privileges have been already granted as aforesaid, shall distinctly use, practise their several inventions by them invented and found out, according to the true intent and meaning of the respective letters patent and of these presents. Provided likewise, nevertheless, and these our letters patent are upon this express condition, that if the said A. B. his executors, administrators and assigns, or any person or persons which shall or may at any time hereafter during the continuance of this grant, have or claim any right, title or interest, in law or equity, of, in or to the power, privilege and authority, of the use and benefit of the said invention hereby granted, shall make any transfer or assignment, or any pretended transfer or assignment, of the said liberty and privilege, or any share or shares of the benefit or profit thereof, or shall declare any trust thereof to or for any number of persons exceeding the number of five, or shall open, or cause to be opened, any book or books for public subscriptions, to be made by any number of persons exceeding the number of five, in order to the raising any sum or sums of money under the pretence of carrying on the said liberty or privilege hereby granted, or shall by him or themselves, or his or their agents or servants, receive any sum of money whatsoever of any number of persons exceeding in the whole the number of five, for such or the like intents or purposes, or shall presume to act as a corporate body, or shall divide the benefit of these our letters patent, or the liberty and privileges hereby granted, into any number of shares exceeding the number of five, or shall commit, or do, or procure to be committed or done, any act, matter or thing whatsoever, during such time as such person or persons shall have any right or title, either in law or equity, in or to the said premises, which will be contrary to the true intent and meaning of a certain Act of Parliament, made in the sixth year of the reign of our late royal great grandfather, King George I. intituled, "An Act for the better securing certain powers and privileges intended to be granted by his Majesty by two charters for assurance of ships and merchandizes at sea, and for lending money upon bottomry, and for restraining several extravagant and unwarrantable practices therein mentioned." Or in case the said power, privilege, and authority shall at any time hereafter become vested in or in trust for more than the number of five persons, representatives at any one time, reckoning executors and administrators as and for the single person whom they represent, as to such interest as they are or shall be entitled in right of such their testator or intestators; that then and in any of the said cases, these our letters patent, and all liberties and advantages whatsoever hereby granted, shall utterly cease, determine, and become void, any thing hereinbefore contained to the contrary thereof in any wise notwithstanding. Provided also, that if the said A. B. shall not particularly describe and ascertain the nature of his said invention, and in what manner the same is to be performed, by an instrument in writing under his hand and seal, and cause the same to be enrolled in our High Court of Chancery, within two calendar months next and immediately after the date of our said letters patent, that then these our letters patent, and all liberties and advantages whatsoever hereby granted, shall utterly cease, determine, and become void, any thing hereinbefore contained to the contrary thereof in any wise notwithstanding. And lastly, we do by these presents, for us, our heirs and successors, grant unto the said A. B. his executors, administrators and assigns, that these our letters patent, or the enrolment or exemplification thereof, shall be in and by all things good, firm, valid, sufficient and effectual in the law, according to the true intent and meaning thereof, and shall be taken, contrived, and adjudged in the most favourable and beneficial sense for the best advantage of the said A. B. his executors, administrators and assigns, as well in all our courts of record as elsewhere; and by all and singular the officers and ministers whatsoever of us, our heirs and successors, in that part of our united kingdom of Great Britain and Ireland, called England, our dominion of Wales, and town of Berwick-upon-Tweed aforesaid, and amongst all and every the subjects of us, our heirs and successors, whatsoever and wheresoever, notwithstanding the not full and certain describing the nature and quality of the said invention, or of the materials thereto conducing and belonging.

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* Three distinct patents must be obtained for the three several united kingdoms of England, Scotland, and Ireland; but the Colonies may be mentioned and comprised in the English patent.

Witness ourself at Westminster, this
day of in the year of our reign.

From a review of the statute 21 James I. c. 3, and of the form of the patent, it will appear, in the first place, that a patent cannot be granted for more than *fourteen years;* that it must be for the *sole working* or *making* of any manner of *new manufacture* within these realms, to the *true* and *first inventor,* which *others* at *the time* of making such letters patent shall not *use,* so as also they be not contrary to the law, nor mischievous to the state, by raising prices of commodities at home, or hurt of trade, or generally inconvenient.

And that, secondly, according to the form of the patent, if at any time during the term it shall be made appear to the King or his Council that the grant is contrary to law, or prejudicial or inconvenient to the King's subjects in general, or that the invention is not a *new* invention, as to the *public use* and exercise thereof in this realm, or not invented and found out by the patentee, the patent shall be void. Also that it shall give no licence to *use* or *imitate* any invention or work whatsoever which has heretofore been found out or invented and *publicly used* in this realm, and for which a patent has been granted. Also that if the patent be transferred to or *in trust for* more than five persons, or to any who act as a corporate body, or in contravention of the act 1 Geo. I. for securing the privileges granted by charter to the Royal Assurance Company, &c. And lastly, if the patentee shall not, within a given time, *particularly describe* and ascertain the *nature* of his *invention*, and in what *manner* it is to be *performed*, by an instrument in writing under his hand and seal, to be enrolled in Chancery, the patent will be utterly void.

In the conclusion, the patent contains a grant that it shall be construed most beneficially for the patentee, which is not the case with ordinary grants from the crown.

By particularly attending to the passages in italics, we shall have a clear view of the most useful part of the law concerning patents, arranged in an order entirely practical.

As to the time or duration of patents, they are limited to fourteen years; but by Act of Parliament, in particular cases, and under special circumstances, they have been continued for a longer period, as in the case of *Boulton* and *Watts*' steam-engine, and several other instances.

From the words in the statute, sole working or making of any manner of new manufacture, it is plain that the object of the act was to encourage domestic trade and manufactures in general, and not mere scientific discoveries.

The word *sole* conveys to the patentee what is ordinarily called the monopoly, but which is more properly the exclusive right of manufacture; for as is observed in the case of *Boulton* and *Watt*, it is the *working* or *making* of the manufacture which is protected, and not the *sole buying* and *selling* a manufacture, which could hardly be brought within the qualification, that the patent shall not be contrary to law, or prejudicial to trade. Were it extended to the sale of the invention, none but the patentee could vend his own invention, and the manufacture could be sold but once; but by restricting the *working* or *making* of the article, all interference with the interest of the inventor is sufficiently prohibited.

Notwithstanding, however, these obvious considerations, *foreign articles* are considered as new manufactures upon their *first introduction here,* although they may have been sold abroad;* and patents are consequently frequently granted for inventions which are made known from the communications of foreigners, it being indifferent in law whether a man be learned by travel or by study, the object being to encourage improvements in arts and manufactures.

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* Edgebury v. Stephens, Salkeld's Reports, ii. p. 227.

The terms new manufacture come next to be considered, and the construction of these words seems to have occasioned all the difficulties that have occurred.

By the term *new* is not to be understood that every thing in the manufacture shall be novel and strange, which is impossible, but that essentially it shall be different in some main and *principal* point, from all other manufactures of the same kind, hitherto used in these realms.

Hence it has been held, that a patent for an improved manufacture is good.*

But as it is obvious that the improvement is the essential novelty, a patentee, by adding an improvement to an old manufacture, cannot entitle himself to an exclusive right in the whole manufacture: but the public must have the same right of using the old manufacture as before.

The patent must therefore be confined to the improvement; and when a patent was taken out for a watch, and the invention was merely an improvement, by the invention of a particular movement, such as an escapement, it was held void.†

Upon this point, as well as others, the leading case of *Boulton* v. *Bull* appears to have turned. Mr. Watt had improved the steam-engine, by inventing a new method of condensing the steam, which saved steam and fuel. This consisted in condensing the steam out of the cylinder, and keeping the cylinder hot. The mechanical form of the cylinder, or of the condenser, might be varied in many ways; but whenever these were separate, the essential properties of Mr. Watt's invention were imitated.

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* Per Lord Mansfield in Morris v. Branston, Bull. Ni. Pri. 77.

† See Jessop's case, cited in Boulton and another v. Bull, 2 H. Blacks. p. 463.

The Court, upon further investigation, considered that the terms of the patent claimed no other right than this, of making all condensers and cylinders, in which the steam should be condensed out of the cylinder, and held the patent good.

It is upon this principle that the case could alone be supported, and when thus explained, it appears plain and simple; but such is the confusion of language, that entirely for want of a good technical description, this patent was litigated with great force, and supported at least with great difficulty.

Manufacture is the next important word in the statute, and is supposed to be applied to *principle* or to *method*, for which latter it has been argued a patent cannot be granted.

Yet in the case of *Boulton* v. *Bull* the patentee had described his invention as a new principle, and had claimed his right for the particular principle, and there are daily instances of patents taken out for a method.

We shall endeavour to reconcile these apparent inconsistencies, which, like many others, arise from verbal disputes.

The word manufacture has two senses. It means a thing made with hands, and in some cases the making of a thing with hands. In either of these senses, when the thing made is a vendible substance, essentially new in some particulars, it may be the subject of a patent either for the whole substance produced, or for the particular novelty in it, as the case may be, and as the one is separable from the other.

Manufacture, in this sense, is as universal as artificial substance; as the things which hand can produce; as the mechanical arts; and as practical chemistry. It is to artificial productions and mechanical substances, or vendible commodities of man's own invention, modification, and contrivance, to which the patent right applies.

It excludes all natural productions, all engrossing of newly imported minerals, seeds, or animals, or their raw products, and it is opposed, as it should seem, to all mere manipulations or acquirements of manual dexterity, as well as to all scientific principles.

These consist in mere *methods*, or in *ideas* and notions, which are incapable of being restrained by any patent.

It has, however, frequently happened, that the patentees have described their inventions as *methods* and *principles*, where they have been, in reality, actual new *manufactures*, or new *processes*, in manufacture.

In these cases there is no peculiar effect to be attached to the particular words, but the Court has so construed them as to consider the whole of the patent together, and thence decided whether the patent was in effect for a new manufacture or not, and this we shall exemplify when we come to treat of the specification.

"*Within these realms.*" It is by the effect of this clause that, as we have seen before, a foreign invention may become the subject of a patent upon its first importation into Great Britain.

"*To the true and first inventor.*" Hence, it appears, that the patent can only be granted to the inventor, and not to his assignee. But who is the first and true inventor is a question sometimes of difficulty.

In the case of *Dollond's* patent one *Hall* had originally made the discovery of the principle upon which the acromatic telescopes were afterwards constructed; but he, says Lord Chief Justice *Eyre*, in the case of *Boulton* v. *Bull*, made the discovery in his own closet, but never made it public: and on that ground *Dollond's* patent was sustained.

It should seem, however, that if *Dollond* had not himself also discovered it, he could not have been entitled to the patent.

But when one *Tennant* had, in 1798, obtained a patent for an improved bleaching liquor, a chemist at *Glasgow* deposed, that having had frequent communications with him, he had suggested that *Tennant* would obtain his object by keeping the lime water constantly agitated; and *Tennant* afterwards, in 1796, two years before the patent, told him this *method* or process had succeeded. A bleacher at *Nottingham* also deposed that he had used it five or six years before the patent, though he kept his process a secret from all but his partners and two men concerned in preparing the liquor.

Upon these grounds the *plaintiff* was nonsuited, in an action brought for the infringement of the patent, and tried December 23, 1802, before Lord Ellenborough, Chief Justice, and a special jury.

"*Which others at the time of making such letters patent shall not use.*"

This clause is a farther explanation of the meaning of the words *new manufacture*, namely, it must be something which is not in use, or has not been made in this realm by others, at the time of granting the patent. And this must clearly be understood of a *bonâ fide* use, for if, while in the attempt to construct the machinery, some workman should surreptitiously pirate it, the original inventor would still be entitled to the patent by force of the previous words "*the true and first inventor*," and such a fraudulent use could not be a bar to his claim. Even if a patent were granted by surprise to the other party, it should seem that it might be revoked on a *scire facias*, and a new one granted to the true inventor. But it is presumed that a patent obtained under either of these circumstances would be of very doubtful validity.

"And also that they be not contrary to the law, nor mischievous to the state, by raising prices of commodities at home, or hurt of trade, or generally inconvenient."

This clause is the least definite in its meaning and application of the whole act.

In the case of the King v. Arkwright,* an issue was taken upon the *scire facias,* "that the patent was inconvenient to the king's subjects in general." But upon this issue the learned judge said, that it was merely consequential, and he could not receive any evidence upon it. It stated no fact which a jury would try, nor which the defendant could come prepared to answer.

Patents under the act 21 James I, cannot properly raise the price of commodities, because they are in effect for new commodities, of which there can have been no current price previously. But, as was before remarked, if a patent should be obtained for a foreign invention, and the patentee charged more than it can be imported for from abroad in its perfect state, it would seem that such a case would fall within this clause, and the patent be inconvenient to the public, and tend to raise the price of commodities. Such a case, however, is not likely to occur, and the whole may be considered rather as a saving clause of extreme caution and little practical effect.

With regard to the patent itself, many of the clauses and operative words which we have marked, are mere repetitions of the restrictions imposed by the statute, and contain a reservation of the right or power of the crown to recal the patent, in case it shall have been imposed upon; all which has been already sufficiently discussed.

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* Bull. Ni. Pri. 77.

It next contains a proviso, making the patent void upon its being transferred to, or in trust for, more than five persons, or in contravention of the act which establishes the Royal Exchange and Royal Assurance Companies.

The precise policy of this clause is by no means apparent, as to the assigning it in trust for more than five persons.

For if it is an invention of a manufacture so costly that it cannot be carried on without the joint capital of more than five persons, to restrain it to less is hardly beneficial to the community, since it is to forbid its use. Whereas if one alone may exercise it, there seems little difference to the community, whether the profit is shared between few or many; and parliament have removed this difficulty, when required, as in the case of the straw paper manufacture, for which an act was passed enabling sixty persons to be concerned.

The most important clause in the patent is that which requires the specification to be filed or enrolled within two months or such other time as shall be specified by the patent.

"This instrument must particularly describe and ascertain the nature of the invention, and in what manner it is to be performed."

If this description be false it is clearly void.* Even if it is unnecessarily ambiguous, so as to mislead the public, who are entitled to know the correct process, it is said to be bad.† As where in a process for making yellow paint, *any* fossil salt was directed to be used, when only *sal gem* would produce the effect, the patent was held void. So where in tempering steel trusses the patentee had omitted to state the rubbing of them with tallow, which was a necessary process, the patent was held void.—*Liardet* v. *Johnson.*

So if the process stated in the specification does not produce the substance for which the patent is obtained, it is void. As where the patent was for producing a yellow colour and making white lead by one process, and white lead could not be produced by it, the specification was held to be bad, and the patent void.

The object of the specification is to enable the public to have the benefit of the general use of the manufacture after the expiration of the patent right; and therefore the machine, manufacture, or process, should be so clearly described as to enable any person of ordinary capacity in the trade or manufacture of which the invention is an improvement to make or produce it; but it need not contain mere incidents known to every common manufacturer; in the same way as, if any article were mixed with gold in a state of fusion, it need not set forth how gold is to be fused or melted; and where it is for an addition or iprovement, it will be only necessary to state the rticulars of the addition or improvement, and how hey are to be attached to the old machine.

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* Bull. Ni. Pri. p. 77.

† Per Ashurst, J. 1 T. Rep. p. 602.

Drawings of machinery are not absolutely requisite, ut must necessarily be added where it is difficult to nderstand the mechanism without them. Many ersons of judgment and experience, among whom may be named the late Mr. Nicholson, whose assistance in preparing specifications was much sought, have strongly recommended their omission where a sufficient description could be given without them, on the principle that in the event of a reference to a jury, upon any question of an infringement, they were apt to confine their view of the invention to the precise drawings in the specification, although the infringement complained of might be the same, only varying the form of the machinery.

In the case of *Boulton* v. *Bull*, the specification of Mr. Watt's *Engine* was without a drawing, and it was held that the specification was complete without.

The time of enrolling the specification must be strictly observed, as, after the patent is once granted, no extension of the period can be obtained.

There are two remedies by which the patentee may protect his right.

He may at common law bring an action upon the case for damages, or he may file a bill in equity against the party for an injunction to restrain him from using the manufacture, and for an account of the quantities which he has made and sold, and that the party shall pay over the profits.

In the first place the plaintiff must give evidenc in support of his specification to show that he ha actually produced the manufacture, machinery, substance, or improvement, which is the subject of his patent. He must then prove the infringement of it on the part of the defendant; and should the contrary party be unable to show that the invention was not new at the time the patent was granted, nor that the patentee had violated, or not complied with, any of the provisoes of the grant, he will be entitled to a verdict for such damages as he can prove he has sustained.*

The remedy in equity is stated to be preferable to an action at common law, because the party may, in the first instance, be restrained from further using the manufacture, and must by his answer confess the extent of the injury.

When different persons, not partners in trade, have in different instances infringed a patent, the party must file separate bills against each, and cannot join the cases in one bill.†

Where a patent is improperly obtained, the usual way to set it aside is by applying to the Court of Chancery for a *scire facias* at the suit of the crown, which will issue on the authority of the *attorney-general* upon the application of any private party.

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* Bull. Ni. Pri. p. 77.

† Per Ashurst, J. 17 Rep. p. 602.

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THE

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OF

PATENT INVENTIONS, &c.

No. VII. JANUARY, 1826.

Specification of the Patent, granted to WILLIAM HOPKINS HILL, *of Woolwich, Kent, lieutenant in the royal artillery, for certain improvements in machinery for propelling vessels.*—Dated Feb. 26th, 1825.

WITH A PLATE.

TO all to whom these presents shall come, &c. &c. *Now know ye*, that in compliance with the said proviso, I, the said William Hopkins Hill, do hereby declare, that the nature of my said improvements, and the manner in which the same are to be performed, are particularly described and ascertained in and by the drawing hereunto annexed, and the following description thereof, (that is to say,) instead of using a number of fixed paddling boards upon the circumference of the body of a wheel, as in present general use, I attach to the body of a wheel at equi-distant points of the circumference four paddle boards having movement upon horizontal axes: the paddle boards have each a lever attached, (see figs. 3 and 4, Pl. I.) with branched or forked arms: the arms of the different paddles have a particular and relative position to each other explained in figs. 1 and 2, so that by connecting their heads by short connecting rods a particular quantity of alternating movement is permitted to the paddles; this alternating movement is reciprocating between paddle and paddle, and is effected on the rotation of the wheel by the resistance of the water against which they act; that is to say, that the movement of one paddle upon its axis, causes thereby the movement of the next in a contrary direction, and so on around the circle.

Fig. 3 is a front view of a paddle complete as attached to the arms of the wheel in a vertical position, and shows also the position of the framing or cross bracing of the principal arms of the wheel.

Fig. 4 is a side view of a paddle lever attached to a section of the paddle board.

Fig. 5 is a side view of one of the straps attached to a section of the paddle board.

Fig. 6 shows the form of the connecting rod or link of the paddle levers.

In figs. 1 and 2, the body of the wheel is omitted, the better to show the paddle levers, their action, and the geometrical lines explanatory of the construction and movement. In these two figures the lines, *a b—a b,* show the water line. Fig. 1, exhibits the four paddles radiating from the axis of the wheel, one paddle being then vertical in the water.

Fig. 2 shows the equal immersion of two paddles, and the full quantity of their reciprocated action.

The dimensions of those parts of the wheel and mechanism connected with the movements are geometrical, and in a ratio with the distance of the axis of the wheel from the surface of the water, the water-line being a side of the inscribed square to the circle upon which the paddle axes are situated, (as shown in fig. 2.) so that when two paddles are equally immersed the water line cuts them upon their axes of movement.

In figs. 1 and 2, four connecting rods are shown between the paddle levers, but I am of opinion that for

Fig. 1.

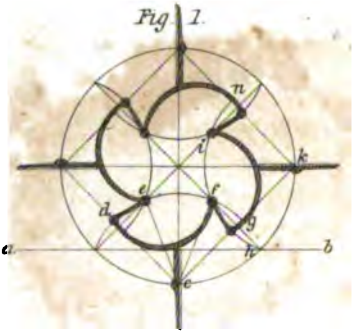


Fig. 2.

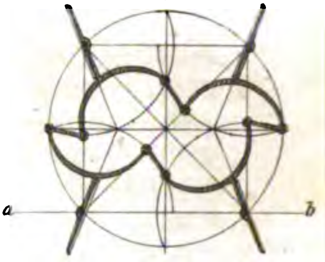


Fig. 7.

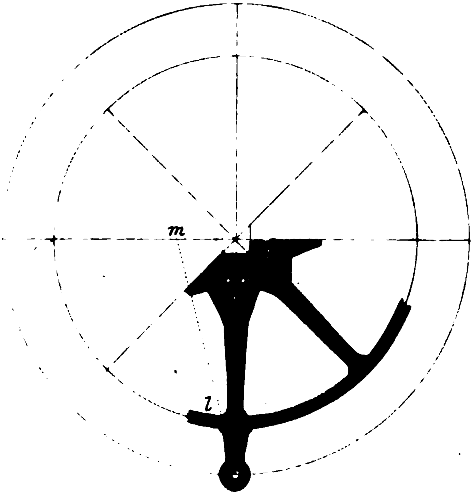
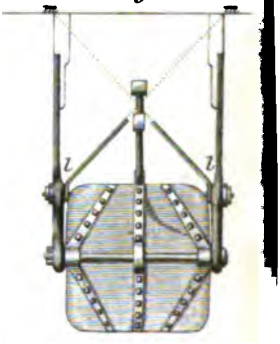


Fig. 3.



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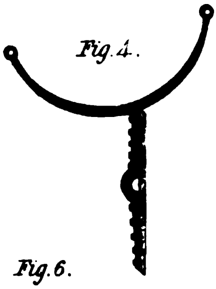
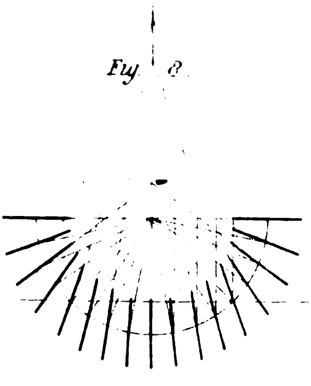


Fig. 8.



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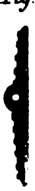
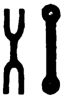


Fig. 6.



practice one might better be withdrawn, as the connection between the four levers may be effected by three, and any small deviation from geometrical correctness in the construction would not so much affect the movement as with the circle completed; here also it is to be observed is a provision in case of accident to any one of the lever arms so connected by shifting the connecting rod to the other arms.

Fig. 7 explains the construction of the body of a wheel suited to receive the paddles and internal movement. The principal object to be attended to is to keep the cross or diagonal bracing free of the paddle levers; this I have effected by extending the four principal pairs of arms beyond the outer rim of the wheel, giving the projecting parts of the arms greater strength, and then bracing them cross-ways, from the position of the rim to the centre plate in the directions shown at *l m*, figs. 3 and 7; this cross-bracing occurs at each of the four principal pairs of arms. A portion only of the body of the wheel is shown, the other parts being the same repeated.

Fig. 8 is a diagram explaining the position of the paddles during a half revolution of the wheel.

In assistance of the paddle movements I am of opinion that a small superiority of paddling surface below, or without the axis of the paddles, may be preferable to their turning upon their centres of surface.

The geometrical construction of the parts constituting the movements is as follows:—having described a circle having the axis of the wheel as a centre, and the water line, a side of the inscribed square, take an angle of the inscribed square *c* fig. 1, as a centre, and with a side of the inscribed octagon as radius, describe the arc *d e f g*; also from an adjacent angle of the same square at *k* describe a similar arc *h f i n*; then it is to be seen in this figure that the head or joint *d* of one arm of the paddle lever, falls upon the intersection of the arc *d e f g* with the side of the square *c d*, and the head of the other arm at the intersection of the two arcs at *f*, the stem or principal part of the lever falling upon the radius of the circle: the length of the connecting rod is the chord of one fourth of the arc or quadrant *defg*.

Having given a description of the various particulars necessary to be attended to in the construction of this mechanism, I have to observe that the object I have in view in these improvements is a better and more perfect application of the propelling power.

In this specification I claim as my invention the peculiarities of the paddle movements, namely, their reciprocating action upon each other as described. I do not mean to claim the movement of paddle boards upon horizontal axes; but the peculiar application of that movement.

I also disclaim the different parts constituting this mechanism which are in general use, but claim those peculiarities of construction, proportion, and arrangement, necessary to effect the paddle movements before described.

I do not limit myself to the number of four paddles, nor to the particular quantity of their alternating movement, although I believe those set forth to be the best. Neither do I confine myself to the precise method of effecting the reciprocating action between the paddles.

In witness whereof, &c. &c. &c.

OBSERVATIONS BY THE PATENTEE.

The proper and efficient employment of the whole of the engine power is set forth as the leading advantage to be derived from the use of wheels of the above mentioned construction. These advantages will, it is conceived, be found of greater importance to sea going vessels than those for river navigation, for with the latter the defects of the common wheels are comparatively of fixed and known quantities, but at sea, in bad weather, where the full and just employment of the powers of the engines are most required, they have been supposed by experienced and judicious persons to misapply not less than from two-thirds to one-half of the power of the engines; it is therefore under such circumstances that the great superiority of this new wheel will be manifest.

On examination of the diagrams explanatory of the movements, it is believed that the paddle strokes will be ascertained to be perfectly elliptic, which is conceived to be the correct principle, and that upon which fishes and all other animals make progress in the water; and it is claimed that this stroke has not the negative quality of entering the water and leaving it *without* misapplying force, but that every part of it is equally perfect and efficient.

But besides the true direction of the propelling force, there are several points of important consideration connected with this construction. It may be observed that at the proper water level there is always the quantity of one paddle surface in action; a perfectly regular and continuous force is therefore applied by the rotation of only four paddles, in consequence of which the effects of a rough sea will be little felt, as no great accumulation of resistance can occur as with the common wheel; indeed, with an immersion near to its axis it is only for a short space of time that the entire surfaces of two paddles offer themselves, in addition to which the jarring tremulous motion so much complained of in steam vessels, both in river as well as marine navigation, will not exist with the elliptic movement even in rough weather, to the great comfort of the passengers, and the ease and safety of all the moving and other parts of the machinery. Although at the proper level the water line should cut off the quarter circle of the wheel (as shown in the diagrams), yet it may be immersed to a depth one-half between that and the axle, or even (it is believed) near to its axis without misapplying force to the extent of the common wheel in its best position;—a quality of this nature is highly desirable for merchant vessels, or any others subject to variation in freight. On this account also vessels may carry a considerable quantity of canvass with a side wind, which cannot be accomplished to advantage with the common wheel.

There will, upon this construction, be ample scope for the employment of abundant paddling surface without extending the width of the wheel to half that of the common one. For a central position of the paddling wheel, (should vessels hereafter be well constructed for the arrangement) these dimensions would be particularly favourable. Indeed, considering the greater depth and freedom of the paddle stroke acting constantly in undisturbed water, it is probable that a much smaller paddling surface than at present exposed might be found sufficient.

It has always been held of great importance, in case of accidents to the engines, to have recourse to prompt means of withdrawing all impediments to sailing. By removing one paddle, the new wheel may be so fixed that no obstacle will occur below the axis of the wheel, excepting the two arms which have but small immersion.

In mill-work where water wheels are of too great diameter, or not properly placed with regard to the fall or stream of water, and the water, after having acted upon the floats, accumulates behind the wheel and clogs its movement, the presence of that which is termed *back-water* is a great defect, absorbs considerably the powers of the fall or stream, and should not exist: but with paddling machinery the accumulation of water behind the paddle stroke is a natural consequence of using the water as a resistance for propelling the vessel, and is of itself no defect. One of the defects at present in steam navigation is the misemployment of this water, by the misdirection of force upon it.

That there will be an accumulation of water behind the new wheel to a certain extent, there can be little doubt; but its resistance will be turned to good account by the action of correct forces upon it. So much has been here said respecting back-water, because to a considerable extent it seems a received opinion amongst persons connected with steam navigation, that the presence of back-water is in itself a defect which it is an object to remedy; on the contrary, if ever machinery should be invented which would effect its removal, it would be found that so natural a result as back-water could only be destroyed by great absorption of the propelling powers of the engines.

Having now remarked upon the leading properties and advantages conceived to be possessed in this construction of a paddling wheel, it may be well to consider such objections as may be urged against it.

Taken in a general point of view, and to a certain extent, objection to joints or moving parts without the vessel, and exposed to the injurious action of salt water, may hold good, for without doubt their decay will be more rapid than parts situated within; but then it follows as a point of consideration whether these parts are of such expensive nature as to make their periodical renewal a matter of importance.

As connected with the present project it may be answered, that the joints may be made of greater substance than if for internal application, so as to allow for certain wear without over reducing strength: and then, that those parts are of small dimensions, and that at very small expense spare sets of them may be in readiness for immediate use.

It may be asked, what will be the effect of a rough sea upon the paddle movements?

Attention may here be drawn to the consideration that the surfaces above and below the axis of the paddle are arranged to counterpoise each other, or nearly so, therefore there can be little cause of movement by any resistance which the entire of the paddle may meet with, either from immersion or from a stroke of the sea. It is its upper part is closed by a lid or cover which slopes towards the front of the stove, and is made to turn back at pleasure, by vertical hinges, and to shut down on a rebate at the top edge of the fire back plate, as shown in the section, fig. 4. The space above the fire and coal chamber *c c*, and the passage *d*, are nearly similar to other air stoves, having a descending flue to carry off the smoke.

A third method of attaching a coal chamber to the fire chamber is shown in figures 5, 6, and 7, which represent a front view and sections of a kitchen or cooking stove, commonly called a "range." The sides of this coal box are similar to that in figures 3 and 4, but the cover or lid is made to shut down horizontally, forming a level with the top plates or hobs of the grate as shown in sections 6, 7, at *g*. The bottom of this coal chamber, instead of being formed simply of an iron plate, resting on a bed of certain materials, (to be hereafter described) as in the preceding figures, is formed by the top of a boiler, (shown at *b*, fig. 7,) made of iron or other metal, which boiler also extends round the sides of the fire chamber, in order to bring it more immediately in contact with the fire. It will be proper to face the edge of this boiler with an additional thickness of iron, to protect it from the immediate effect of the fire. The object of this boiler being the plentiful supply of steam, or of boiling water for the various operations of cooking, or heating by steam, its appendages for conveying off the steam are similar to those in common use, and consequently form no part of the claim of the patentees for the present invention.

The operation of these arrangements for consuming smoke are as follows: suppose any kind of grate or stove (provided with this coal chamber) to require replenishing with fuel, instead of throwing on coals in the usual way at the top of the fire, it is to be thrown into the chamber behind, and the door or cover immediately closed. The fresh fuel, on reaching the bottom of the chamber, and coming in contact with the ignited fuel, will immediately evolve that dense or opake smoke always observable from fresh coals. This gaseous matter being prevented from making its escape, (either into the chimney or the apartment,) through the upper part of the coal box, is compelled to pass through the mass of burning fuel at the lower part of the grate, previous to ascending the chimney flue. By which operation its offensive portion, the tar vapour and carburetted hydrogen gas, instantly inflames in combination with the oxygen of the atmospheric air, while the azote of the common air, and the ammonia and carbonic acid gases, pass up the chimney with rapidity almost in an invisible form, and consequently without depositing soot in any material degree in the chimney, or impregnating the external air with the black carbonaceous matter of ordinary coal smoke. The coal box is calculated to contain sufficient coals for a day's consumption. But it would be more economical, and afford a more complete combustion of the guseous part of the coal, (which forms more than one-third of its valuable properties,) if coals be supplied in small quantities, according to the usual practice. For in the event of the coal box being nearly filled, all the gaseous portion of the coal will be consumed in the early part of the day, while the dull coke or cinder would be reserved for the latter part of the day. As the coals become successively reduced to the state of coke, it may be brought forward from the aperture of the coal box, and raised into the grate, as requisite, by the point of a poker.

The other objects of the patentees, to economise fuel, and regulate the heat evolved from stoves or grates for warming apartments, and for the various operations of cooking, are to be accomplished by the following arrangement.

In lieu of the detached fender, and the opening beneath the fire, in stoves and grates of ordinary construction, a basement or projection is to be attached to the front of any register or other stove, immediately beneath, and in contact with the bottom of the fire bars. This basement may be made of any kind of metal plates, or of marble or other stone, or artificial stone, cement, or clay, in combination with metal plates or bars. It may also be made of any figure and any dimensions, according to individual taste or fancy. The basement must be provided with a drawer or box to receive the ashes beneath the fire, in the front of which drawer should be a sliding ventilator, in order to admit a current of air beneath the fire grating. On each side of this ash box cavities or chambers are to be formed for the reception of certain substances known to be imperfect or slow conductors of heat. A mixture of pulverised charcoal and lime is the substance the patentees chiefly recommend for this purpose, though they do not restrict themselves to any peculiar materials, but employ any of the mineral substances which are slow conductors of heat. These cavities being filled with any such slow conducting materials, the basement will form a solid mass with the plates forming the body of the stove. On each side of the fire bars, the back part of the front plates or face of the stove, is also to be provided with cavities or chambers (of any requisite depth) for receiving a portion of the said slow conducting materials. The front plates of these cavities may be formed either of metal, or any kind of stone or cement, and be fixed parallel with the front of the grate, or placed in an oblique direction, at the discretion of the manufacturer. The space, *f*, in the section, fig. 2, is also to be filled with the same materials, and also the whole of the cavity formed by the plates of the canopy, or cornice, *d d*, figures 1 and 2. The materials to be pressed or beaten into the cavities, so as to form a solid mass with their respective surfaces. The sides and back of the several cavities should neither extend to the entire width of the front of the stove, nor to the entire depth of the recess of the fire place, in order to avoid that loss of heat which would ensue from the actual contact of the body of the stove with the brick work of the chimney.

Immediately beneath the top plates of the basement, two passages are to be made leading from the draft hole, or ash box, and, having a deflection towards the fire bars, be made to terminate in apertures on each side of the basement. These passages are for the purpose of creating a current of air on each side from the draft hole, which air becomes warmed by contact with the point of the basement, and subsequently flows out into the apartment through the side orifices. These orifices may be provided if necessary with ventilator or regulating plates similar to those applied to the ordinary air stoves.

Suppose the respective cavities of a stove, according to this plan, to be filled up with any of the before mentioned slow conducting materials, and a fire to be lighted in the grate, it will be obvious, that as the fire comes in contact with the basement and sides of the stove, a great portion of the heat given out from beneath the fire, (and which in ordinary stoves is lost to the apartment through being immediately driven up the chimney,) will in this case be absorbed and retained for a time, by the materials which form the basement and lower parts of the stove herein described. Thus, for example, if two stoves be made, one on the usual construction of register stoves, and the other with the improvements before mentioned, and having the fire chambers of equal dimensions; and supposing a fire to be kept in each for a given number of hours, and then extinguished; while the register stove (constructed wholly of iron or other metal,) will have become cooled down to the temperature of the atmosphere of the room, within half an hour, the basement and other parts of the improved or "Thermo Regulator" stove, will retain a portion of its heat from four to six hours, according to the dimensions of the stove, and its mass of non-conducting materials. The gradual evolution of this caloric from the surface of the improved stove, may also be greatly economised for maintaining the warmth of any apartment, by closing the register plate at the top when the fire is quite extinguished, and thus preventing the rapid escape of the warm air up the chimney in waste. With the several adaptations and appendages before mentioned, the improved stove combines the advantages of the close chamber stoves generally used on the continent of Europe as to economy, and exemption from smoke; with the cheerful aspect and comfort, peculiar to open-fire stoves.

The draft or ascending column of air will in most cases be sufficient to maintain an active or brisk fire in these improved stoves, owing to the additional heat and rarefaction produced by the combustion of the smoke. But in certain cases, where the bad construction, or too great area of chimney flues, occasion a remarkably bad draft, the patentees apply a small pipe to the basement of the improved stove, which pipe is to be connected with a reservoir of air, (in a kitchen or other convenient apartment,) the reservoir to be filled by a pair of lever (or forge) bellows; or the air pipe may be immediately connected to the nozzle of the bellows without any reservoir. This arrangement enables a brisk fire to be produced at all times in a few minutes, and without the necessity of having a servant enter the apartment for that purpose. This air pipe also furnishes a most convenient mode of supplying any requisite quantity of fresh or cold air, for the purpose of ventilating and cooling apartments during the summer season. For which purpose the air pipe, after it is brought into the corner or other convenient part of the room, is to have a branch leading to the basement of the stove, and another branch carried up and opening near the ceiling; each of these branches to be furnished with a stop cock, to be open or shut at pleasure. These pipes may be made of any requisite dimensions, and rendered ornamental, or concealed from view, at the discretion of the workmen.

The slow conducting materials before mentioned are also capable of being applied with advantage in economising the heat from detached or air stoves. The basement of the stove *ff* (figures 3 and 4,) is to be filled with these non-conducting materials, leaving a space for the ash box, and descending flue, as shown in section, fig. 4. But in warm air stoves, with lateral or ascending flues, the basement may be filled up solid. The iron plates which form the coal chamber, *a b*, (fig. 3,) should also be lined on each side with a portion of the same materials, and the exterior surface of the fire chamber (usually termed the "cockle" in stoves of this description,) should be covered with plates or fire tiles, to prevent the air from being vitiated by contact with the surface of hot iron plates. The exterior of this stove is similar to that of air stoves in general.

The peculiar advantages, however, which this kind of air stoves possess over those in common use, (and for which the patentees claim to be the inventors) are derived from the coal chamber, and appendages for burning the smoke. For the principal objection to the general introduction of air stoves with descending flues, arises from the great liability of the horizontal or other flues to become choked with soot, and consequently to endanger buildings by taking fire. But as the combustion of the crude smoke destroys full four-fifths of that carbonaceous matter, which would otherwise be deposited in the flues or pipes, the liability to block up these flues with soot must consequently be reduced in the same ratio, from the use of air stoves with these appendages for burning the smoke.

The several improvements which the patentees have effected in the construction of cooking stoves or grates, consist, firstly, in the adaptation of the coal box, and boiler beneath (as before described); secondly, in the application of an oven on a peculiar construction immediately above the fire chamber of such cooking stoves or grates. The form of such oven, and the arrangement for directing and economising the heat in a cooking stove, with this appendage, will be easily understood from the drawing, fig. 5, and its sectional parts, figures 6 and 7; the front plate being removed from figure 5, in order to show the interior.

The bottom and sides of the oven, *d*, are to be formed of wrought or cast iron plates, bent into a curvilinear, or polygonal form, with horizontal flanches or ears at the top, by which flanches the oven is to be fixed by means of screws or rivets to the cast iron plate, *h*, which extends across the top of the entire stove or grate. The oven, previous to being fixed, is to be filled to a certain extent, with any kind of cement, fire stone, or clay tiles, (nearly in the form represented at *d d*, figures 5 and 6,) with the view of preventing the too powerful action of the fire on the bottom of the oven, and for rendering the heat uniform in its interior. The side plates, *i i*, may be considered a continuation of the plates forming the exterior of the oven with apertures shown at *k k*, about 3 inches wide, and from 12 to 15 inches long, from front to back, to allow the passage of hot air or smoke into the chimney flue. The iron plate should also have corresponding openings cast in it, or be made of three separate pieces with intervals between, as seen at *h h h*. The three portions of this hot plate should be lined, or covered with blocks of fire stone, or any slow conductor of heat, in order to prevent the radiation or loss of heat from the top of the oven. The spaces, *l l*, on each side of the oven, serve as hot closets or auxiliary ovens in the upper part, while the lower parts, in contact with the hot plates of the stove, may receive the usual culinary vessels for steaming or boiling, a communication being made through the hob to the steam boiler in the usual way. The partitions, *m m*, on each side of these warm closets are to be formed of thin brickwork or tiles, and carried up so as to enclose the ends of the hot iron plate, *h h h*. A back partition or wall of the same materials, is also to be carried up to the same height, from the back edge of the stove (as shown at *e*, fig. 6,) in which wall a regulator plate is to be fitted so as

Fig. 1.

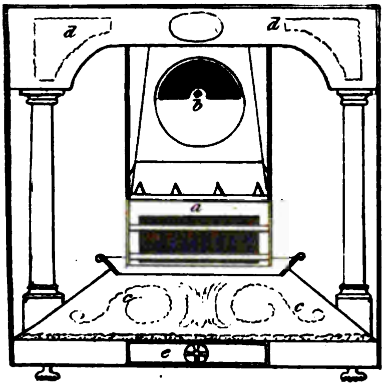


Fig. 2.

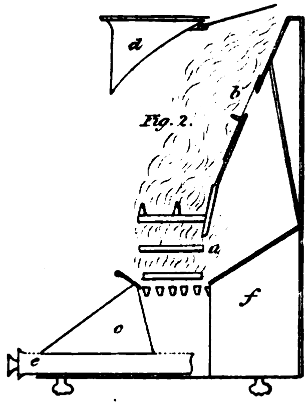


Fig. 3.

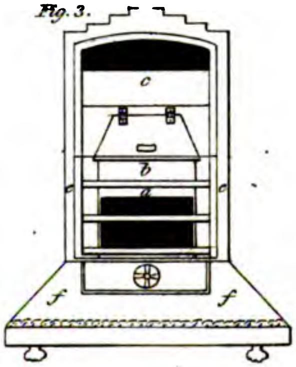


Fig. 4.

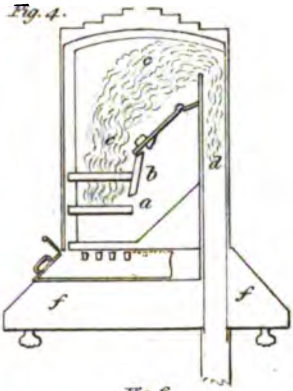


Fig. 5.

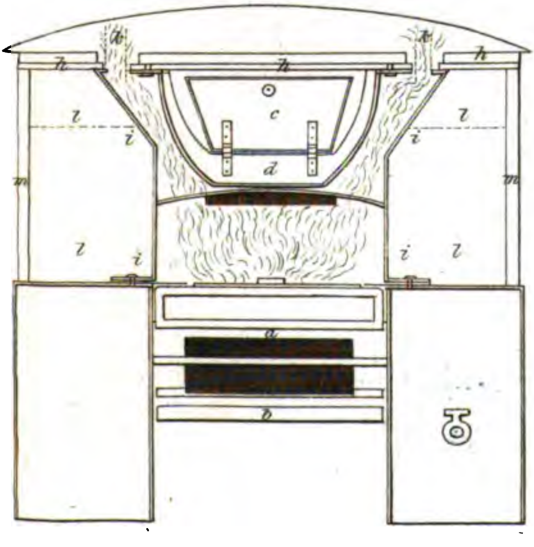


Fig. 6.

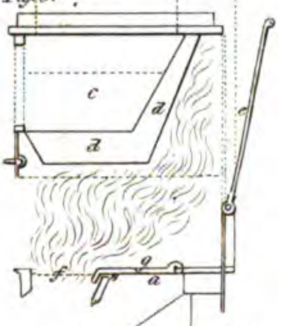
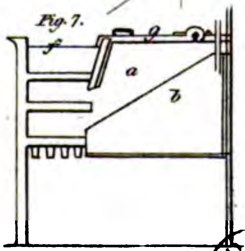


Fig. 7.



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to close the aperture into the chimney at pleasure. By closing this register plate, the whole of the hot air and flame will be directed towards the narrow passages through the top plate, after having given out a portion of its heat to the bottom and sides of the oven, as well as the top plate, a certain portion also being given out to the side plates and chambers, *l l*. If the heat be too great beneath the oven, the register plate is to be fully opened, and a detached iron plate made to slide in immediately beneath the oven, so as to direct the flame and hot air through the back opening into the chimney. The front of these passages and ovens or chambers may either be constructed of iron plate altogether, or of brick-work with doors of plate iron, faced with tile, in order to prevent the radiation of heat into the apartment. It is scarcely necessary to remark, that the heat beneath the oven will be considerably augmented by the occasional application of a plate called a "blower," in front of the opening between the top bar of the grate and bottom of the oven.

The peculiar advantages attending a kitchen stove having the appendages before mentioned, are, that the oven may be more uniformly, and far more economically heated by a given quantity of fuel, than by any of the usual arrangements of flues leading from the side of the fire, and the very simple construction of the draft passages and apertures, together with the combustion of the crude smoke, in a great measure prevents the inconvenience to which all such flues are liable from the deposit of soot.

The patentees do hereby further declare the specific parts of stoves and grates of which they claim to be the inventors, are, the application of a box or chamber for receiving the fuel preparatory to burning the crude smoke in open fire grates; also the construction and application of the basement, cornice, and other parts hereinbefore described, (however such parts may be varied in their form,) for saving fuel, and regulating the temperature of the air in apartments; and, lastly, for the construction and application of the improved oven before mentioned, with its appendages for economising heat in kitchen or cooking stoves.

In witness whereof, &c.

OBSERVATIONS BY THE PATENTEES.

The specification of the before-mentioned improvements in stoves and grates, including a statement of the operation of these improvements, in practice, as well as the principles and form of their construction;—very few remarks will be sufficient to point out the advantages resulting from the use of the "Thermo Regulator" stove. In the first place, that great nuisance in social economy, termed a "smoky chimney," is almost effectually prevented; by consuming the noxious portion of the smoke, and at the same time accelerating the escape of the remainder. 2dly, The deposit of soot in the chimney flue will not amount to one fourth of the usual quantity; consequently, both the danger attending foul chimneys, as well as the inconvenience of sweeping boys, will be obviated in a proportionate degree. 3dly, The construction of these stoves prevents the loss, or consumption, of a large quantity of fuel, through absorbing great part of the caloric given out by the burning fuel; and which, in grates of the usual construction, is immediately driven up the chimney. 4thly, The heat which has been absorbed by the materials of this improved stove, being gradually evolved into the air of any apartment, will warm such room more uniformly than by an ordinary stove; while it diminishes in a great degree the inconvenience of those cold currents of air from doors and windows, which always supply the place of the warm air driven up the chimney flue. 5thly, From the additional heat given out by the combustion of the smoke, and the subsequent economy of the caloric by the materials of this stove, the saving of fuel amounts from one-third to one-half the usual quantity necessary to maintain an apartment at a given temperature during twenty-four hours. And, lastly, The auxiliary air-pipe attached to the "Thermo-Regulator" stove, enables a room to be ventilated, and maintained at all times nearly of an equable temperature: thus affording a protection from over-heated assembly or other rooms during winter; and increasing the salubrity and comfort of such apartments during the summer season.

Specification of the Patent granted to JAMES AYTON, *of Trowse, in the county of Norfolk, Miller, for an instrument or spring to be applied to bolting mills for the purpose of facilitating and improving the dressing of flour and other substances.* Dated February 19, 1825.

WITH A PLATE.

TO all to whom these presents shall come, &c. &c. *Now know ye*, that in compliance with the said proviso, I, the said James Ayton, do hereby declare that my said invention is herein set forth and explained, reference being made to certain parts of the drawings hereunto annexed. But previous to describing the particular improvements I have invented, I shall briefly explain the machinery now in use for bolting flour, meal, and other substances. The bolting mill is that part of the machinery of a flour mill to which the bolting cloth is fixed or applied for dressing flour and other substances. It is generally composed, in the way hitherto used, of six bars of wood, united by arms passing through an axle, forming, when so combined, a circle whose diameter is generally twenty-two and a half inches at the upper end or head, and tapered to twenty and a half inches at the tail or lower end; but in some instances they are twenty-two and a half inches throughout, in which case they are called equal reels, to distinguish them from the taper ones. The bolting cloth is a cylindrical sieve, and considerably larger in diameter than the reel upon which it is fixed. At each end of the bolting cloth a strip or band of leather is fastened to it by being neatly sewed. This serves to strengthen the cloth; and the leather fixed to the head or upper end of the cloth has a drawing string inserted in it, for the purpose of confining or fixing it over the rim at the head of the reel. At the bottom of the bolting cloth six loops are attached to the tail leather; each of these loops is brought to the end of each bar, drops into a notch made to receive it, and so fixes the cloth at the tail of the reel. The reel is placed in an inclined position, and made to revolve rapidly within six bars of wood, called beaters, fixed to the box or case which contains and incloses the reel. These beaters are placed parallel to the bars of the reel, at equal distances around it (but in some cases the upper bar is left out), and about half an inch distance from each bar of the reel when they are placed opposite each other. The reel, when set to work, is turned with great velocity, and the centrifugal force would throw out, to its utmost extent, the bolting cloths, were it not intercepted by the beaters. Whilst a constant stream of meal is entering the bolting cloth at the upper end, the continual and repeated blows of the cloth against the beaters forces the flour through the mashes of the cloth, which, without the action of the beaters, would soon be clogged or choked up. The offal, consisting of bran, pollard, and sharps, are, by the inclination of the reel, delivered at the tail end of the bolting cloth. The complete success of the operation depends very much upon two particulars: first, the rapid and powerful vibration of the bolting cloth; secondly, the equable manner of its action upon the beaters. Both of these requisites, according to the present mode of fastening the loops to the bars of the reel, are very imperfect, the only vibration (and which is very trifling) being obtained from the elasticity of the cloth, while, from the stretching of the leathers at the head and tail, and also the loops, with various other causes, the cloth frequently takes an eccentric position upon the reel, performs its work but slowly and imperfectly, and when going at a great rate, or not regularly supplied with meal, is sure to be partially injured or torn to pieces. To obviate these inconveniences, and improve the method of using bolting cloths, I have invented my patent adjusting instrument or spring, the method of applying and using which will be explained by referring to the drawings, 1 and 2, (Pl.III.) hereunto annexed. Fig. 4, in drawing 2, represents a plan of my instrument or spring complete, and fit to be fixed by two screws to the iron axis of a bolting reel. A is a cylindrical ring of iron or other metal, into which are rivetted the six elastic steel arms or springs, *a, b, c, d, e, f;* the extreme end of each is formed into a broad hook, to receive a loop fixed to the tail leather of a bolting cloth. These hooks are neatly rounded, and made very smooth, to prevent the loops being injured when the spring is in action. B is a centre ring, which is also cylindrical. This receives the ends of the two conical pointed screws, *g* and *h*, which are secured in the outer ring, A, and in this way form two centres of a universal joint: *i* and *k* are two conical pointed screws, secured in the centre ring, B. These enter conical holes in the centre socket, C, exactly at right angles with the screws, *g* and *h*. The socket, C, is made with a square aperture in its centre, to fit upon the square iron axis of a bolting reel, where it may be made fast in any convenient part by the two fixing screws, *l* and *m*. Fig. 5 shows a side view of fig. 4, the same letters of reference being applied to the same parts wherever they can be seen. Fig. 6 represents a section of the universal joint, showing the way the ends of the elastic arms or springs are inserted; the section of this part is taken through the line D E, in fig. 4. When this instrument or spring is fixed upon the proper part of the axis of a bolting reel, and the loops at the tail leather of the bolting cloth are placed in the hooks, at the extremity of the arms or springs, instead of being drawn into the notches at the ends of the bars of the reel, a very constant and uniform tension will be kept upon the bolting cloth, so that when set to work each part of it will strike the beaters with equal force, it will preserve a proper degree of vibration, and thereby cause it to perform its work in a safe, speedy, and highly beneficial manner. But in order to use this instrument or spring in the most advantageous manner, I have applied certain improvements to various parts of the bolting machine, which I shall now describe; but I do not claim the sôle right of using them, as they are not intended to be secured by this patent. Drawing 1, fig. 1, represents a side elevation of a bolting machine, the inclosing doors being removed, in order that the internal parts may the more easily be seen: A A A A represent the bars of the frame upon which the bolting machinery is placed: B B is a wrought iron axis: upon this the mace, C, is fixed by a screw: *a a a a a a* are six semicircular arms of iron, only four of which can be seen in this view. These arms are fixed to and support a wooden cylindrical rim, D, and thereby form a frame to fix a net upon; and when the meal enters in a stream, it has the effect of spreading or dispersing it equally over the upper and internal surface of the bolting cloth: *b b* are two arms of iron, fixed also to the mace, C; two similar ones are fixed in the same mace at right angles; and D represents another mace, fixed on the same axis, having four bars or arms, *c c c c*, similarly placed and fixed in it: *d d* represent two pieces of duck, five or six inches wide, fixed at each end to the arms or rods, *b b* and *c c*. Two similar pieces of duck are fixed also to the other arms, the edge of one being seen at *e e*. Each of these pieces is made to extend about an inch beyond the end of each arm, and the whole constitutes a winnow, over which the bolting cloth is drawn, and being made fast to the rim, D, by the running string before-named, the loops fixed to the tail leather are placed in the hooks of my patent instrument or spring, and then the most perfect and equal tension will be effected upon the bolting cloth; and if the beaters are adjusted of a proper distance from the cloth, then the most beneficial effect will be produced. It is well known that various circumstances occur which make it necessary to adjust the beaters either nearer the bolting cloth, or further distant from it, as occasion may require. This adjustment is attended with considerable trouble as the bolting machinery is at present constructed, and such trouble and loss of time are the cause of very frequent neglect in that most important part of the process. To remedy this inconvenience I adopt the following simple means. Drawing 1, *fig.* 2, represents an end view of a bolting machine, corresponding with fig. 1: E E is a cast-iron plate or ring, let into a recess formed in the tail board, F F F. It is confined therein by the brackets, *ffff*, but is at liberty to move or turn concentric with the axis, B, of the reel. Another plate or ring, exactly similar in every particular, is let into a recess in the head board, a side view of which is seen at G G, in fig. 1. These plates have in each six grooves, as shown at *gggggg*, in fig. 2, equally distant from each other, and they are made eccentric to the centre of the ring; and on the edge or periphery of the ring or plate, a few teeth or cogs are formed, which gear into a pinion, H, fixed upon a spindle, I, which spindle will be best seen at I, in fig. 1. A similar pinion is fixed on or near the other end of the spindle, I, which gears into the cast-iron plate let into the head board, and when the spindle is turned either way, both the plates move simultaneously: *hhhhhh*, represent six radial grooves or slits made in the tail board, shown by dotted lines in fig. 2; six similar slits or grooves are made in the head board, and exactly opposite those in the tail board: *iiiiii*, represent six cylindrical bolts with square heads, the other ends being tapped and screwed into the ends of each beater, the bolts being previously passed through the eccentric grooves of the circular plates and radial slits or grooves in the head and tail boards. This method of combining the parts will be easily understood by carefully comparing both figures of drawing 1. When a winch is applied to the squared end, be it at the head or tail, as most convenient, of the spindle, I, fig. 1, the pinions fixed to it being geared into the teeth of the cast-iron plates, E E, will turn them partly round, and these, by their grooves acting upon the bolts, *i i*, &c. will cause the beaters to expand or contract their distance from the cloth with the greatest ease and facility. By this simple contrivance the distance of the beaters may be adjusted in an instant; and by the use of a winnow, instead of the common reel, as herein described, the injurious effects of the reel bars upon the cloth will be avoided most completely. As the outer extreme edges of the four pieces of duck pass within about three quarters of an inch of the beaters, there is always an open space of eight or ten inches in the centre, round the axle, from the inner extreme edges of the winnow; and as this part of the machinery of a bolting mill revolves with great rapidity, the pieces of duck set the air in very brisk motion, and this circumstance tends very powerfully to force the flour through the meshes or interstices of the bolting cloth, while the instrument or spring keeps the cloth in a constant state of tension and tremulous vibration, thereby preventing any tendency that the flour may have to clog and fill up the interstices or meshes of the bolting cloth. Fig. 3, of drawing 2, represents a side view of the winnow separated from the bolting machine. The same letters of reference are applied to the same parts as in drawing 1. The instrument or spring is shown fixed upon the axle, B, in a proper place to have the loops of the bolting cloth applied to it. And in order to identify and distinguish my invention more particularly, I, the said James Ayton, do hereby declare that my invention consists entirely in the application of an instrument or spring, as described and set forth in figs. 4, 5, and 6, of drawing 2. And although I prefer the method of constructing the universal joint, and of making and combining the springs or elastic arms, as therein described, yet, the same beneficial effect may be produced by using

N°1.

Fig 1

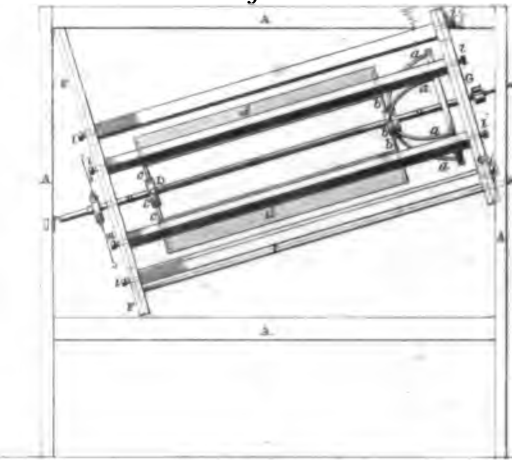
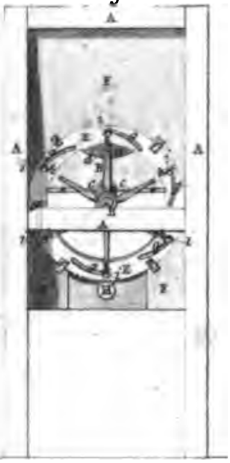
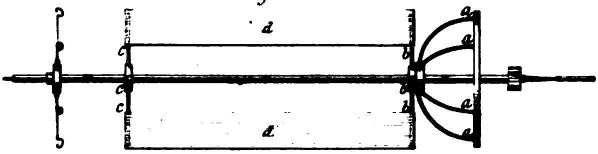


Fig 2



N°2.

Fig. 3.



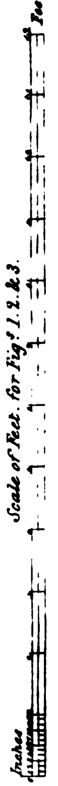


Fig. 4.

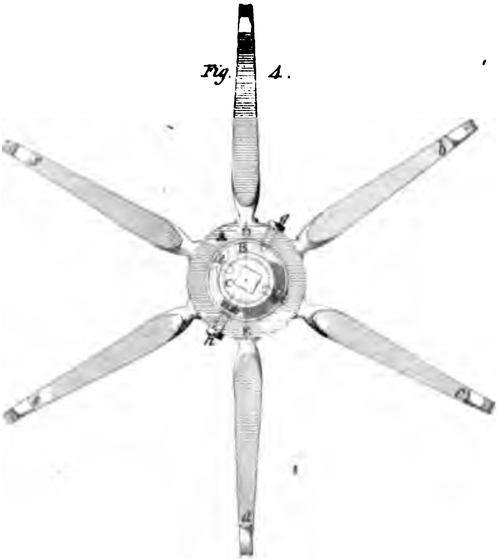


Fig. 5.

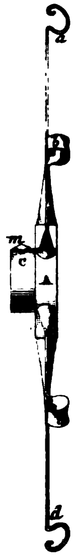
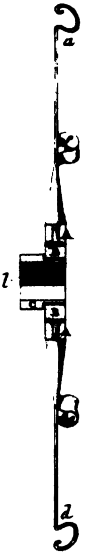


Fig. 6.



spiral springs attached to non-elastic arms, fixed to a universal joint, to which the loops of the bolting cloth may be applied, or in many other simple ways known to workmen, without departing from the principle herein contained, namely, that of applying a spring to give tension to the bolting cloth, by the application of which the dressing of flour, meal, and other substances, will be greatly facilitated and improved.

In witness whereof, &c.

OBSERVATIONS BY THE PATENTEE.

The patent for making, vending, and granting a licence to use the adjusting spring, is assigned to Messrs. Blackmore and Co. Patent Bolting Cloth Manufacturers, of Wandsworth, Surrey.

A bolting mill of the common kind is found to dress 50 per cent. faster by the application of the Patent Adjusting Spring *alone*; but with the apparatus above specified, the rate of dressing is increased in a still greater degree.

At Trowse Mills, near Norwich, (Mr. Bell's) by this improved mode of its application, in the presence of the following eminent master millers, viz.

Mr. James Bell, Trowse;
Mr. J. Culley, Cossey;
Mr. W. Toll, Keswick;
Mr. W. Partridge, North Walsham;
Mr. S. Parmeter, Aylsham;
Mr. J. Colman, Stoke;
Mr. Edward Dent, for Messrs. Culleys and Pratt, Hellesdon;

the result of two hours' trial, through two of Messrs. Blackmore and Co.'s, No. 15, Patent Bolting Cloths, one on the old reel, the other with the patent spring and new apparatus, driven by the same power, at a fair speed, and at the same time, was as follows:

	Sacks.	st.	lb.
By the old mill were well dressed	5	5	6
By the patent spring and new apparatus were well dressed	8	12	5

do believe this said specification doth, in all respects, fully, and without reserve or disguise, comply with the proviso in our said hereinbefore in part recited letters patent contained; and do hereby intend to maintain our exclusive right and privilege to our said invention.

In witness whereof, &c. &c.

OBSERVATIONS BY THE PATENTEES.

The principle of this improvement is simply in the power which any alkaline sulphuret has of converting oil, resin, &c. into soap, as well as potash, or soda, connected with the peculiar facility which the bleacher possesses, of getting quit of the sulphur in the operations which follow, after it has effected the purpose of an alkali. From the comparative cheapness that the sulphuret can be made, and also from those materials from which it can be obtained, being always in such abundance at home, it may render the manufactories connected with bleaching independent of any political interruptions which might affect the supply of potash from abroad.

The great obstacle with which the makers of alkali from the sulphates of soda and potash have to contend, separating the sulphur from the sulphuret, is entirely avoided; for it will answer the intention of the bleacher in dissolving the oil, resin, &c. contained in goods made from hemp, flax, or cotton, and thus expose the bare fibre to the bleaching effects of the acids and atmosphere which follow in the process, as well confined with sulphur as free from it; and the immersion in acids and spreading on the ground-works, the goods must go through whatever alkali is used, will as effectually precipitate the sulphur and remove the green stain, as any thing that could be applied for that purpose alone.

The bleacher who makes his own chemic, is well situated for working upon this plan to advantage, because he has not only in the sulphate of soda, contained in the refuse of his stills, the supply of a material for making his sulphuret, which will be equal to the demand he has for it, but it can be made into the article he wants, by the most cheap and easy means. If he has a pit near his stills made water-tight, he has only to spread a layer of small pit coal in the bottom of it, and when the stills are wrought off, let the residuum run upon it; upon this spread another layer of small coal, and so on in alternate layers. When it is dug out, it is taken to, and thrown into a reverberatory furnace, the only apparatus wanted, and which is not larger or more expensive, though differing a little in construction from those in common use, for baking the bleachers' ashes from the spent leys of potash: no notice need be taken of the manganese, as this will separate in the filtering vessels. One bushel of common salt used in making bleaching liquor, or powder, will return from this furnace about one hundred weight of sulphuret; and from eight to ten hundred weight of this ash will yield alkaline ley sufficient for bleaching one ton of linen yarn. The cost of this, where coals are 8s. per ton, including every expense, will be about 1s. per hundred weight.

In the application of these leys there is only one point to which it will be necessary for the bleacher to pay attention. This arises from the greater quantity of solid matter, the amount of the sulphur contained in these leys, than is contained in the leys of potash: and from this circumstance, when a boil of goods is finished, and the spent leys are to be run off, care should be taken to cool and rinse them well with cold water; otherwise, if they are suffered to get dry in the pan before washing, the solid matter, which has been dissolved in the ley, will fix upon the goods and discolour them. The same care will also be required in bucking; but this process, for middle works, for yarns at least, may be omitted, and a cheaper and more expeditious plan substituted for it, by using cold ley in the chemic troughs in this way. When the chemic is exhausted, run it off; and, having command of water to run into the troughs, fill them instantly with clear water, and wash the goods by turning for a few minutes the rollers on which the yarn still remains. This water is then let off, and about four inches more water run in. This being mixed with a small quantity of cold ley, the rollers are again turned for a short time, till all excess of acid is neutralized, and the yarn is saturated with an excess of alkaline ley. This nearly exhausted alkaline ley is then run off; the troughs are again filled with water, and the yarn is washed upon the rollers as before. It is then taken off the rollers, and wrung and shaken for spreading.

The advantages which this process will be found to possess over boiling and bucking, are not only a saving of time, labour, and fuel, and at the same time requiring no care to prevent foul ley from evaporating, drying, and discolouring, as in the two former operations, but there will be a great saving of weight in the yarn treated in this way. Whether this saving may arise from the quietness of the process causing the goods to pass through several stages of their progress without any change of position, and from the hanks on the chemic rollers always moving through the fluid in the direction of the length of the thread, which may tend as much to lay any loose fibres more closely to the body of them and preserve weight; whereas in boiling and bucking, where the motion of the fluid is quite the reverse, acting cross-way of the thread, there is a tendency to loosen and detach them, and lose weight. Whether this may be thought sufficient to account for the saving of weight is not material; but the fact is certain, and is of considerable importance to the manufacturer.

Plan for building a Tunnel under the river Thames, for foot passengers; the original project by Mr. CHARLES WYATT, *late of Bedford Row; the mode of operating by Mr.* JOHN ISAAC HAWKINS.

Abstracted from the Papers and Documents of the "THAMES ARCHWAY COMPANY."

Width of the river at high water,	847 feet
Ditto at low water	649 feet
Greatest depth at high water ..	38 feet 7 inches
Ditto at low water	16 feet 9 inches

IT is proposed to make a brick tunnel, of a cylindrical form, 10 feet 9 inches in diameter outside, and 8 feet 6 inches inside, leaving 13½ inches, or one brick and half, for the thickness of the wall. The tunnel to be built in lengths of 50 feet each, and floated over the required situation, where they are to be sunk into a trench prepared for their reception, and afterwards covered over with earth, even with the bottom of the river.

The particulars of the operation are detailed as follows:

1. In a dock communicating at pleasure with the river, build a cylinder with bricks laid in Roman cement, 50 feet in length.

2. Let the ends of the cylinder be formed into steps and other projections, to keep it even with the other cylinders to which it is to be joined.

3. Close the opening at each end with an hemispherical wall, and in the upper part of the cylinder, about 6 or 7 feet from one end, fix a cast iron tube, of 6 inches bore, having a conical plug ground into it. To the lower end of this tube screw or bolt another tube, 8 feet 3 inches long, and on the upper end screw or bolt a pump, of rather larger diameter, reaching at least 46 feet perpendicularly above the cylinder.

4. At 6 or 7 feet from the other end of the cylinder, insert a piece of iron, into which screw a mast, standing parallel with and reaching the same height as the pump,

being also of the same diameter. Both these must be supported by braces, screwed into pieces of iron fixed in the brickwork. The axes of the pump, mast, and cylinder, must be all in the same vertical plane.

5. At the distance of 12½ feet from the ends, let into the upper part of the brickwork two iron hooks, strong enough to suspend, in water, the cylinder with its appendages. These hooks may be supported by iron hoops inclosing the cylinder.

6. Fix a cock in one end of the cylinder, near the bottom, having a lever worked by a connecting rod 40 feet long.

7. A man hole, secured by a strong iron plate, should be left at the top of the cylinder, in case it may be found necessary to examine the inside.

8. Put inside the cylinder, for ballast, paving stones enough to form a pavement 5½ feet wide, and a sufficient quantity of pig or other iron, to make it float with the masts upright.

9. Admit water into the dock to float the cylinder; shift the ballast till it floats upright; secure the man hole, and force the cylinder under water, where it should be kept for some time. When the work proves to be water tight, take down the pump and masts, with their braces, observing to mark them so that they may be put up again in the same situations.

10. While the cylinder is under preparation, dig, in the deepest part of the river, and in the line where the tunnel is to be laid, a trench deep enough for the cylinder to lie in, with its upper part about 6 feet below the bed of the river.

11. To form a scaffold for letting down the cylinders, provide six bases of cast iron, having spikes at the undersides, somewhat like a harrow, to keep them from sliding along the bed of the river; each base having three sockets, to receive as many balls, armed with ferrules, into which common scaffold poles are fixed.

12. Lash together the three poles so that they stand perpendicular to the plane of the base.

13. Fix, by means of the poles, three of the bases in a line on each side, near the edge of the trench, 16 feet apart.

14. Lay, across a barge, a platform, containing two windlasses, of the double barrelled kind, 25 feet asunder, each 10 feet long; the larger diameter 2 feet, and the smaller 20 inches; moor the barge over the trench, untie the three poles belonging to each base, and tie them to those of the adjoining bases and to the platform, so that they form supports and braces for it.

15. To counteract the specific levity of the scaffold, load the bases with pigs of iron, let down by ropes, the ends of which may be made fast to the scaffold.

16. Put a rope of at least 2 inches diameter on each windlass, to suspend the cylinder by, and a pulley on each rope.

17. A steel spring should be laid under each axis of the windlasses, to indicate, by the degree of flexure, what force is at any time exerted on the ropes, by which means it will be easy to guard against overstraining them.

18. The cylinder may be guided in any lateral direction, by small ropes fastened to the scaffold, and acting on the suspending ropes at a distance below the windlasses.

19. Thus much being prepared, tow the cylinder over its destined situation, within the scaffolding; attach the pullies of the windlasses to the suspending hooks, and erect the pump and mast in their places; turn the cock so as to let in as much water as will give to the whole a small degree of specific gravity more than water; ease it down gradually by the windlasses, until it arrive at its proper place, which will be known by the tops of the pump and masts being in a line with fixed points on the shore.

20. Throw in earth to surround the cylinder, and when it is properly bedded let in water equal to the weight of the pump, masts, and braces, and after drawing the pump buckets, and forcing the conical plug into its place, the whole of these may be taken away, after which the

cylinder may be covered with earth taken from the next excavation, even with the bottom of the river, except the ends, which must be guarded till the next lengths are down.

21. Remove the scaffolding to a new situation for putting down the next length, which will be proceeded with in the same manner as the first, taking care that the ends of the cylinders be made to fit each other and brought into contact; but should this not be perfectly effected, the surrounding earth will form a sufficient barrier to the water, until it can be stopped from the inside.

22. Five hundred and forty four feet being let down in one line, declining about 2 feet to the southward, an ascent, rising one in ten, is to be added to each end; that at the North 196 feet long, and at the South 230 feet. From the top of each of these ascents a spiral way, having winding stairs within it, will afford to the passengers the choice of going up either by an easy acclivity, or by the stairs, according as they consult their ease or value their time. The spiral pathway and stairs will be best made of cast iron; the walls will of course be of brick.

23. When the whole of the cylinders are put down and well covered, break down the hemispherical walls, one at a time; draw the water from the spaces between them, stopping with cement any fissures which may be found; take away the iron tubes that were screwed under the pump, and fill up the man holes with brickwork. It will be proper to begin opening the tunnel from the South side, and when the walls are broken down as far as the lowest point, make a hole down to the present drift,* through which all the water may afterwards pass, and be pumped up by the steam-engine already erected.

24. Lay the pavement and plaster the walls with Roman cement; build the spiral ways at the extremities, and place about nine Argand lamps in the straight parts, and

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* An account of the drift here referred to will be found in vol. xiv. of the second series of this work.

six or eight in the spiral ways. These, however, may be lighted in the day time by means of windows opening into sunk areas.

25. In order to guard against any accident, from the water in the cylinders acquiring a momentum by one end being let down faster than the other, a few partition walls may be built, dividing the space containing the water into different compartments; the walls, however, should have holes in them, to suffer the water to pass from one compartment to the other slowly, so that they may all be emptied by one pump.

26. Should any part of the bed of the river on which a base of the scaffold is to rest, be too soft to give it proper support, one or more extra bases and poles may be put down, and the poles tied to the weak part, or the suspected base loaded with a much greater weight than it is expected to bear in use, and this weight removed on attaching the cylinder to the windlasses. In case, after the cylinder is attached to the windlasses, one of the bases should sink so much as to throw the cylinder out of its place more than can be corrected by the side ropes, the cylinder must be lightened, the defective base forced down by weights, the scaffold untied, and tied again in its place.

27. A channel, nearly as deep as any part of the river, existing within a few feet of low water mark in the South side of the river, an opportunity is afforded of making a complete trial of the plan at a small expence. In putting down five 50 feet lengths, which would reach from that channel to some distance in shore, every difficulty must be met with that is likely to occur in the whole distance, and the strength and fitness of the materials, together with the ease or difficulty of stopping out the water at the joints be accurately ascertained; for, when these five lengths are in their places, all the end walls, except that against the river, may be broken down, and the work examined from the inside.

28. An experiment on a smaller scale might be made,

by putting down two 25 feet lengths in the channel above-mentioned, and erecting a shaft of wood over one of the man holes, reaching to high-water mark, and supported by the scaffold. A man may then go down to examine the inside of the cylinders and of the joint.

N. B. An experiment with two 25 feet lengths was commenced in 1810, and finished in 1811, by Mr. Hawkins, for an account of which see Repertory, vol. XXIV. page 18.

On the Recovery of Land from the Sea. By MR. JAMES BLACKBURN, *Land Surveyor, Lothbury.*

THE art of embanking and draining is perhaps one of the most ancient, for we find that those nations which have been most famous for their works of art, have practised it to a great extent. The Egyptians appear to have been the first nation on record that recovered lands from the water; Sesostris first embanked the cities on the banks of the Nile; and Sabecon, the Ethiopian, employed all persons condemned to death in the same undertaking. The Babylonians were next in this art, for Sir W. Rawleigh, in his history of the world (giving a reason why so little is written of Belus, who succeeded Nimrod, the first Assyrian Monarch), says, he spent much of his time in disburthening the low lands of Babylon, and drying and making firm ground of all those great fens and overflown marshes which adjoined to it. Herodotus, speaking of Semiramis, Queen of Babylon, says "she raised banks throughout the whole level worthy of observation; whereas before she did so, it was wont to be drowned by water:" and again, that Nitrocis, another Queen of the same Empire, raised banks on the verge of the river, for bigness and height wonderful to behold.

In Thessaly, a lake near the hills Pelion, Ossa, Olympus, and Pindus, and which, with the rivers in the neighbourhood, made all Thessaly a sea, was recovered by cutting a passage, by which it flowed into the ocean, and is now a place of great fertility. "Of Acamania this is observable, that where Achilois, a river of that country, runs into the sea, it hath already made continent one half of the islands called Echinades; and that the fable goes, that Hercules here encountering with Achilois (who is said to have transformed himself into a bull, because of the roaring noise of the river), broke off one of his horns, and gave it to Oeneus, in pledge of his marriage with Deianira his daughter. They who collect truth out of fables say, that Hercules, who was generally beneficial, for the sake of Oeneus his father-in-law, restrained the exorbitant overflowing of the river with banks and trenches, and drained a great part of the adjacent country; and this was the cornucopia which the poets made the emblem of plenty."

Not only, however, did the Grecians practise this art, for we find several instances in which it was done among the Romans. In the year 593, when L. Anicius Gallus and Cornelius Cethegus were consuls, the senate directed their attention to the improvement of a great level of waste, lying under water in Latium, about 40 miles from Rome, and engaged a part of the army, then unemployed, in the undertaking; decreeing that one Consul should attend the enemy in Gallia, and the other undertake the recovery of the Pompeian Marshes. This immense undertaking was accomplished, and twenty-three towns were erected on the land which the sea had covered. But, in after times, when civil discords distracted the empire, the embankments were neglected, and the land again inundated; although they were ultimately twice drained by the Emperor Trajan, and Theodoricus, King of Italy. The fens about Placentia were drained by Scaurus; and the territory of Ferrara is yet secured by banks and works which hinder their inundation, particularly by the help of the Rotto di Ficarollo and Ramo di Polistella.

The country of Gallia Cisalpina abounds with rivers, especially that territory belonging to the Venetians, which, lying flat and towards the sea, became, by the flowing of the tides, a fenny marsh; but by the help of trenches and banks, in such a manner as were long before experimented in Lower Egypt, some part thereof has been drained and made useful for tillage. The drainage and embankments of the Fucine Lake was a work of great magnitude, accomplished by the Romans. The Emperor Claudius employed 30,000 men, for the space of seven years, upon this work; and although it was not accomplished by him, yet Adrian, the successor of Trajan, completed the recovery.

In the Belgic Provinces, or Flanders, recoveries of most extensive tracts of fen and marsh land have been effected; for we find that Cæsar's conquests were opposed by them; and a learned writer, Uridius, affirms, that where now is situated the territory of Furnes were mighty fens, extending to the main ocean. Dugdale says, "Much could I say, from the authority of authentic historians, to manifest how full of marshes, lakes, and fens, this country anciently was, though now there is little appearance of it; for, by the industry of the inhabitants, they are so banked and drained that the fertility of it hath made it one of the richest and most populous countries in the world."

"Holland," says Bertius, "is the gift of the ocean and of the river Rhine." And Nannius informs us, that Holland is the gift of the North wind and of the river Rhine, and was in the beginning no more than a higher place than ordinary, over which the tides did usually flow; but that, by some extraordinary agitation of the sea, sand heaps were raised, around which the inhabitants of the adjacent shores made banks, to keep them from their original state: the Batavians, a nation of Germany, were the first to make any efficient embankment of that country. The Danes and the Normans, on their invasion, preserved them in the state the Batavians had left them, and the Saxons contributed to the same work.

Great quantities of land have been reclaimed on the banks of the Loire, in France; and it is well known that Frieseland, Zeeland, and Holstein, in part owe their existence to the embankments of their shores. Did we need seek for further proofs of these undertakings having been accomplished in other countries, we know that the "Celestial Empire" gave to China two of her fairest provinces, by the same spirit of honourable enterprise.

The governments of the nations that have practised this art have always considered the acquisition of additional territory to be of great national importance; but it cannot for a moment be doubted, but that to us, whose insular situation deprives us of neighbouring unoccupied provinces, to which our teeming population may emigrate, the acquisition of portions of land adjoining our shores is of far greater moment; yet obviously true as is this assertion, it is alike extraordinary and unaccountable that fine tracts of land, presented twice every day to the observation of the public, should be lost to all those purposes for which they are so admirably adapted. Commons have been inclosed at such an expense, that the land in many cases is not worth the cost, and the industrious cottagers have thereby often been deprived of one mean of comfort and support; but here is land rich in its quality, capable of producing the finest crops, lost to the country, for the want of that exertion which has been so liberally extended to other undertakings, which in comparison to this are insignificant indeed.

It is stated by Mr. Beatson, in the second volume of "Communications to the Board of Agriculture," and by Mr. Loudon in his work on Gardening, that there are yet about three millions of acres (or one fifteenth part of the whole country) on the English and Scotch coasts which might be recovered and added to the kingdom, and which would prove as valuable land as any part already in cultivation. No computation has been made of the quantity that may be reclaimed in Ireland, but it cannot be less than one million of acres, which, if recovered, would give to that country advantages most apparent. This calculation, however, must of course be in some degree speculative, as no survey has ever taken place; but that the reader may judge how large is the quantity that may be recovered, it should be stated, that every particle of land, whether fen, marsh, or waste, from which the very lowest ebb tides recede, may be embanked, drained, and put into cultivation. It has been objected by some, that a considerable portion of the land so presented would not be worth recovering; this however is a mistake: Mr. Loudon (than whom no man is more capable of giving an opinion on this subject) says, that "no kind of land whatever can be gained from the sea which is not valuable, because it can be flooded at all times by the sea, and frequently by fresh water. By flooding, the most barren land, with only an inch or two of soil, will bear excellent pasture, and much land that is often reckoned barren and useless is partly composed of broken shells, which contain considerable portions of calcareous earth, admirably adapted for productiveness." Indeed the value of land recoverable from the sea is not sufficiently understood. The staple soil is well known to be variable in its quality and produce, but the recovered land most frequently consists of soil from three to four feet in depth, containing fine vegetable matter, the remains of sea-weed, marine animals, and other substances deposited by the tide, saturated with salt, and so extremely fertile, that in many instances it has been cropped for twenty years incessantly without manuring.

Mr. Harriott, who received from the Society for the Encouragement of Arts and Sciences a gold medal for recovering land, in his "Struggles through Life," says, "I think it a reproach to this country that so many thousand acres of rich valuable salting land should lie waste, which at a moderate expence may be inclosed."

In a few instances, however, adventurous men have availed themselves of the advantages offered, and have inclosed land which has proved fortunes to themselves and their families. This has been particularly accomplished in the counties of York, Lincoln, and Norfolk.

In the county of Lincoln Mr. Young, in his Agricultural View of Lincolnshire, informs us that several embankments and drainages have taken place, particularly East and Wildmore Fens, which, after their recovery, were estimated to be worth two millions of money. Deeping Fen, a very extensive tract near Spalding, was also recovered, increasing it in value 600 per cent. In the long reach which extends from Tattersal to Lincoln, between 20 and 30 square miles of country were reclaimed; and in the parish of Long Sutton ten thousand acres have been redeemed from the sea. Indeed so numerous have been the recoveries in this county, that it is calculated that within forty years no less than one hundred and fifty thousand acres have been rendered fertile, which previously were sterile and unproductive.

Near Chester, the River Dee Company has gained many acres from the sea, which have been divided into different beautiful farms, the whole paying a rental of more than 2000*l.* per annum. The Society for the Encouragement of Arts and Sciences has awarded gold medals to several individuals who have recovered several thousand acres in different parts of the kingdom. Mr. Maddock has reclaimed a fine property in Wales, on which the town of Tre-maddock is built; and although the circumstances of that case are peculiar, it will eventually prove a beneficial undertaking. The Earl of Morley has reclaimed a considerable quantity of land near Plymouth; and the Bentinck family, in Norfolk.

These are all, comparatively, modern instances of the practice of the art of embanking and draining: but we have many in which it was done by the Romans and our ancestors to a great extent. Holland Fen, in Lincolnshire, estimated to contain one hundred thousand acres, is undoubtedly a recovery in part effected by the Romans. Romney Marsh, in which fifty thousand acres are embanked, is a work which Dugdale attributed to the same people. Hatfield Chase, Yorkshire, containing ninety thousand acres, was drained in the reign of Charles I.; and the far-famed great Bedford Level, extending no less than sixty-eight miles, and into six counties, was effectually recovered from its inundated state in the year 1649. Many other instances might be produced, were not these sufficient to prove that the process has also been successfully prosecuted in our own country.

Added to these facts, which illustrate the practicability of the proposed undertaking, we may quote the testimonies of many scientific men, whose opinions on the subject have been submitted to the world. Such was Mr. Beatson's opinion on that immense, though practicable undertaking, the recovery of Lancaster Sands. "A thousand difficulties," says he, "would have immediately started up to such a proposal, which, to a more expanded mind, appear perfectly practicable to overcome; what then must they think who are for all things remaining in *statu quo,* when they are told that it was proposed to exclude the sea from a tract of thirty-eight thousand seven hundred and ten acres, which form a bay exposed to a south-westerly wind, more than ten miles across, and where the tide rises from fourteen to eighteen feet perpendicular height." Yet one spirited and enterprising man, the late Mr. John Wilkinson, began a subscription for that purpose, by leading off with the princely sum of 50,000*l.* which, however, on account of private circumstances, he was eventually compelled to relinquish. Duddon Sands, in the same neighbourhood, were viewed by the same individual (Mr. Beatson), in company with Major Gilpin, who both considered that the recovery was most practicable. Mr. Loudon made a survey and estimate for reclaiming Wigton Bay, in Scotland, and other lands, the property of Lord Selkirk, which he considered both practicable and profitable undertakings.

To be continued.

Description of a Self-Acting Feeder for High-Pressure Steam-Boilers.

By Mr. R. W. Franklin, *Tottenham Court-road.*

From the Transactions of the Society of Arts, &c. Vol. xlii.

The Large Silver Medal, and Fifteen Guineas were presented by the Society to Mr. Franklin, for this communication.

WITH AN ENGRAVING.

I request that you will submit to the inspection of the Society of Arts a method invented by me for feeding the boilers of high-pressure steam-engines by means of a float. It is the universal practice to feed the boilers of condensing engines by this method; but to its application in the usual way to high-pressure boilers there are two objections. The first is the inconvenient height of the jack-head, in order to counterbalance the pressure of the steam, (a pressure of forty pounds on the inch requiring the jack-head to be seventy feet higher than the boiler): the second, is the difficulty of packing the float-rod, so as to prevent the escape of steam and yet allow the rod to move easily when acted on by so small a force as the hydrostatic weight of the float.

My improvement consists in the substitution of a heavily-loaded valve instead of a high jack-head, and in avoiding altogether the use of a stuffing box, by placing the lever of the float within the boiler, as will be evident on referring to the representation in fig. 1, (Pl. IV.)

a a Is the top of the boiler, *b* the man-hole, *c* the level of the water in the boiler, *d* a lever suspended by an arm to the top of the boiler, and having the float, *e*, at one end and the counterpoise, *f*, at the other; *g* is a rod of half-inch round iron, connected with that arm of the lever which carries the counterpoise; it passes through the guide or ring, *i*, which is rivetted to the feed-pipe, *k*, and expands at bottom into a round flat disk, *h*.

The feed-pipe, *k*, is long enough to have its lower orifice always below the level of the water, *c;* its upper end is closed by the valve, *l,* and to the bottom of the valve is screwed a long tail or spindle, which, when the valve is shut, descends below the opening of the feed-pipe, and almost rests upon the plate or disk, *h.* As the water lowers by evaporation, the float end of the lever descends and the opposite end rises; the consequence of this will be to raise the rod, *g,* to bring the plate, *h,* in contact with the end of the spindle of the valve, *l,* and thus to raise the valve itself above the opening of the feed-pipe, as represented in the plate. The box, *m,* having been previously filled with water by means of the forcing-pump at the end of the service-pipe, *n n* (not represented in the plate), all reflux of hot water from the boiler is prevented by the valve, *o.* As soon as the pressure of the forcing-pump exceeds that of the steam, the valve, *o,* is lifted and water passes through the pipe, *n,* into the box, *m,* and thence down the feed-pipe, *k,* into the boiler, the valve, *l,* being prevented from closing by the support which it receives from the plate, *h.* As the level of the water in the boiler rises, the counterpoise end of the lever, *d,* descends, and with it the rod, *g,* the plate, *h,* and the valve, *l.* In this position of the machinery the water delivered by the service-pipe raises the valve, *p,* passes into the box, *q,* and flows off by the waste water-pipe, *s.* The valve, *p,* also acts as a safety-valve to the boiler, its pressure being adjusted by means of the weight on the lever, *r.*

The working pressure of the steam in the boiler having been determined, the load on the valve, *p,* must be greater than this, but less than the power applied to the forcing-pump.

Description of an Improved Safety-Chamber to the Oxy-Hydrogen Blow-Pipe.

By MR. HENRY WILKINSON, *of Ludgate Hill.*

From the Transactions of the Society of Arts, &c. Vol. XLII.

The Large Silver Medal was presented by the Society to MR. WILKINSON for this communication.

WITH AN ENGRAVING.

In consequence of an explosion which took place last November, while volatilizing platinum with Mr. Gurney's oxy-hydrogen blow-pipe, I was induced to try some experiments, in order to render that instrument, if possible, more secure. (It is but justice here to observe that at the time of the explosion I was using a much larger and longer jet than any of those sold with the blow-pipe, and differently situated.) If the Society should consider the result I have obtained worth notice I shall be happy to prove the correctness of it by experiment and testimony.

The construction of Mr. Gurney's safety-tube is known to the Society; the chambers in which not being able, under certain circumstances, to arrest the retrograde motion of the flame, I thought it probable that the interposition of any bad conductor of caloric might effectually prevent its return: how far I have succeeded may be judged by the following experiments made with the same jet, all other circumstances of position and dimensions being correctly alike.

Having first chosen such a jet and arrangement of parts as would *always* explode with Mr. Gurney's safety-tube on diminishing the pressure, and would *frequently* so at the moment of ignition, I removed that and substituted another safety-tube entirely filled with wire-gauze; I still, however, found the flame return, driving out the cork every time, as in the preceding experiment.

I then tried a third tube, into which I had introduced, between the layers of wire-gauze and in the centre, some asbestus, previously beaten with a mallet and pulled out, so as to resemble floss silk. With this I could never succeed in causing an explosion to take place, although the flame of a wax taper was kept close to the orifice, and the pressure was diminished as gradually as possible; nor did it explode even when the orifice of the jet was enlarged. These experiments have been repeated by myself, and by a friend, a great number of times, with the same result. I am not aware that asbestus has ever been proposed or employed before for this purpose. The advantage of using this substance is evident, as the fibres cross each other in every possible direction, thus forming a filter for the gases to pass through much finer than any wire-gauze, and by its bad conducting quality it prevents those layers of wire-gauze which are behind it from being heated when an plosion takes place in the cavity of the jet.

The cylinder, *ff*, fig. 2, (Pl. IV.) is of brass, about three quarters of an inch long and the same diameter internally, (the figure represents it of the real size), and is filled in the following order, beginning at the end into which the jet, *j*, screws.

The wire-gauze being cut to fit the cylinder correctly, each disc is introduced separately, having a small quantity of glazier's putty round the edge, and is pressed in with a piece of wood turned to fit the cylinder. After the first ten layers of wire-gauze, *g*, have been introduced, a layer of asbestus, *h*, is inserted one-eighth of an inch thick, equally laid and not pressed in too hard, then come ten more layers of wire-gauze, *g*, another layer of asbestus, *h*, and lastly, twenty discs of wire-gauze, *g*, the two ends of the cylinders being concave, in order to afford as large an area as possible for the passage of the gas from the entrance pipe, *i*, to the jet. As the object of this arrangement is to keep the last series of wire-gauze cool by the interposition of bad conductors of caloric, it appears probable that the safety would be rendered theoretically more perfect if the cylinder itself were a bad conductor, such as earthenware having brass caps cemented on the ends; or platinum, if metal were made use of, on account of its low conducting power. A brass cylinder, however, appears to be perfectly safe for every purpose, as I have never been able to cause an explosion to take place, although I have allowed the flame to retrograde, by gradually diminishing the pressure from 60 to 100 times successively, while using very long jets of one-eighth of an inch in diameter at the aperture and much larger within. The wire-gauze should not be finer than from 3600 to 4900 apertures to the square inch, as it is liable to be fused by the return of the flame. I found that when I used wire-gauze with 8100 apertures it was destroyed in a very short time.

The model which accompanies this letter is made of glass, in order to show the internal arrangement.

Description of an improved Carpenter's Plane.

By Mr. G. Gladwell, *Lower Garden-street, Vauxhall.*

From the Transactions of the Society of Arts, &c. Vol. xlii.

The sum of Five Guineas was given to Mr. Gladwell, for this communication.

WITH AN ENGRAVING.

The object of the candidate, who is a working carpenter has been to make one plane answer the purposes of the jack-plane, the pannel-plane, the smoothing-plane, and the moulding-plane. This he effects by having the bottom, or sole, of the plane moveable, being attached to the body of the instrument by means of a dove-tail groove. The workman, therefore, by being in possession of eight soles, flat, convex, or concave in different degrees and directions, and of five irons, with one stock or body, has an equivalent for eight separate planes, whereby an advantage is gained both in point of expense and also of portability.

It is true that some time will be lost in changing the soles, when a man has to pass frequently from one kind of work to another; but after every reasonable deduction has been made on this account there appears to remain a fair preponderance of advantage in favour of the invention. Care must be taken that the wood employed for the soles is perfectly seasoned, otherwise they may warp, and make inaccurate work.

The following are the directions of the inventer relative to the construction of the plane.

Let one-third of the height of the plane be the thickness of the sole, having a dove-tail fillet (worked in solid, or glued and screwed on,) about three-eighths of an inch thick and two inches wide. In the upper part of the body of the plane make a groove for the fillet to slide in. The sole slides in from the front part of the plane, and secures itself against two brass stops or plates, one screwed on the back part of the plane, the other on the sole in front. The one on the back part answers for all the soles that may be fixed; but each sole must have one in front.

REFERENCE TO THE FIGURES.—(Pl. IV.)

The same letters of reference denote the same parts in all the figures.

Fig. 3, a side view of the plane; *k k*, the sole or bottom portion of the plane fitted to the upper part, *l l*, by a longitudinal dove-tail, *m m*, shown by dotted lines; *n*, a plate of brass screwed to the bottom piece, *k*, to prevent its going too far, and *o*, a plate of brass screwed to the upper portion, *l l*, to stop the end of the dove-tail.

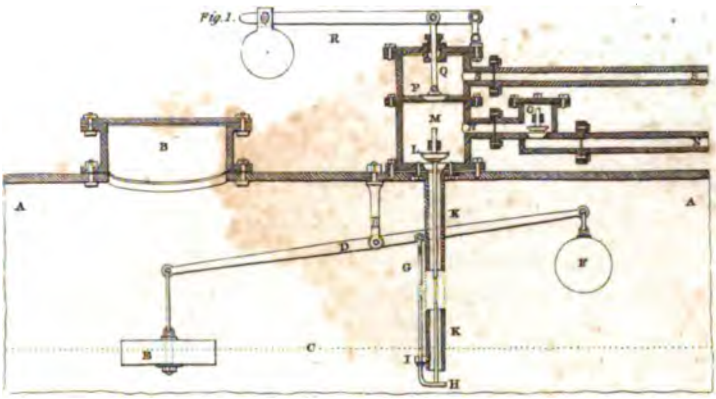
Fig. 4, an end view of the upper and lower pieces separate, to show the dove-tail and groove.

Fig. 5, a concave sole.

Fig. 6, a convex sole, with the brass plate, *n*, screwed on.

Fig. 7, a longitudinally convex sole.

Fig.1.



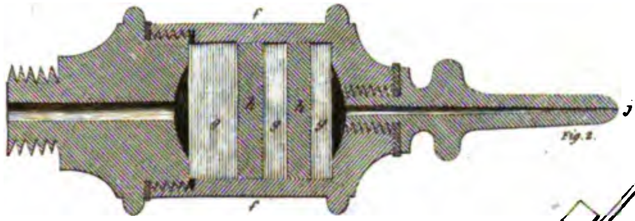


Fig.2.

Fig.4.

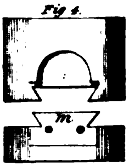


Fig.5.

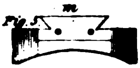


Fig.6.

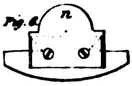


Fig.3.

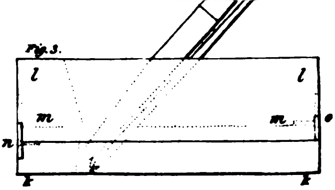


Fig.7.

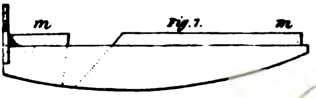


Fig.11.

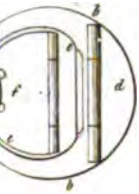
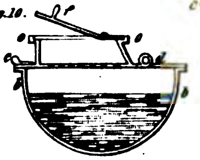


Fig.10.



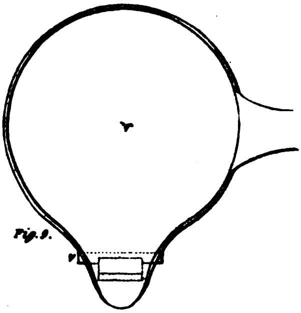
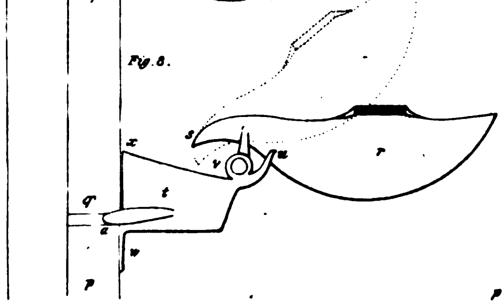
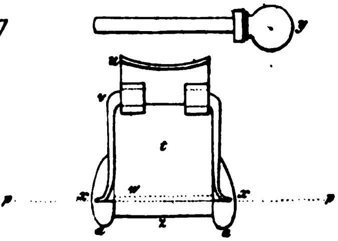


Fig.9.

Fig.8.





Description of a Ladle for Paying the Seams of Ships, and Improved Pitch-Kettle.

By MR. RICHARD SOAPER, *Royal Dock-Yard, Devonport.*

From the Transactions of the Society of Arts, &c. Vol. XLII.

The sum of Ten Guineas was presented to MR. SOAPER, for this communication.

WITH AN ENGRAVING.

IN paying the seams of a ship with pitch (which is done to keep in the oakum with which the seams are stopped) a mop is the instrument commonly made use of. This being dipped into a kettle of hot pitch takes up a certain quantity, and is then rubbed over the seam, care being taken to force in the pitch as accurately as possible. A mop, however, is a very awkward implement for this purpose, being much too large to adapt itself to the seams. Hence a large portion of the pitch requires to be scraped off again, and much falls down on the ground, and is lost. A farther disadvantage is, that the mop presents so large a surface to the air, that in cold weather the greater part of the pitch congeals on its surface, thus occasioning a very serious loss of time.

Mr. Soaper employs, instead of the mop, a ladle with a moveable lip, which fits the seams, and thus conveys the pitch into them when boiling hot, and therefore in its state of greatest fluidity. By this contrivance hardly any loss of pitch is incurred, and a great saving of time is also obtained.

In the ordinary way of applying pitch much falls to the ground, where it gets mixed with chips, shavings, and other impurities; that portion which is scraped from the sides or deck is also in a similar condition, and both are frequently thrown away as useless. Mr. Soaper turns these scraps to good account by connecting a strainer with the ordinary pitch-kettle, whch detains the impurities and allows the pitch to drop through.

The above contrivances, though apparently very simple and obvious, appear not to have been introduced into any of our dock-yards previous to the suggestion of Mr. Soaper; and are certainly calculated to save, in that department of public service, much expenditure and still more valuable time.

Reference to the figures of Mr. Soaper's Pitch-ladle and Pitch-kettle. (Pl. IV.)

Fig. 8, *p p*, a portion of the side of a ship, *q* a seam to be pitched, *r* a ladle, *s* the spout, *t* a lip joined to the ladle at *v*, under the spout, and open against the ship, *u* a tail or heel-piece to butt against the ladle and prevent its dropping lower than level, *w* an iron apron under the mouth-piece, *t*, and flush with the cheeks, *x x*, to fit against the ship's side.

Fig. 9, a bird's eye view having the joint-pin, *y*, taken out to separate the ladle from its mouth-piece, *t*,; *z* the front edge of the mouth-piece bottom, which projects beyond the apron, *w*, and cheeks, *x x*, to enter into the seam; *a a* two solid ears to fill up the seam on each side, and prevent the pitch running out; the dotted line, *p p*, shows the surface of the planks. When the mouth-piece, *t*, is applied to the seam the ladle is turned on the joint, *v*, (as shown by the dotted line *r*, fig. 8,) to pour its contents in the mouth-piece, *t*, and from thence it runs into the seam.

Fig. 10, *b b* a section of a pitch kettle, *c d* the ordinary lid with its joint; this lid carries another vessel, *e e*, the bottom of which is perforated with small holes to serve as a strainer. In this upper vessel is put the pitch which has fallen on chips or dirt, and the pitch as it melts runs through into the kettle, leaving the dirt above the lid of the strainer, *f*.

Fig. 11, a bird's eye view. The kettle is drawn on a much smaller scale than the ladle.

ACCOUNT OF NEW PATENTS.

Patent granted to HENRY MAUDSLAY *and* JOSHUA FIELD *of Lambeth, Surrey, Engineers, for a method and apparatus for continually changing the water used in boilers for generating steam, particularly applicable to the boilers of steam vessels making long voyages, by preventing the deposition of salt, or other substances, contained in the water, at the same time retaining the heat, saving fuel, and rendering the boiler more lasting.* Dated 14th Oct. 1824.

THE method of the patentees for preventing the deposition of salt or other substances, in the boilers of steam-engines, in situations as above described, consists in drawing by a small pump, with a loaded external valve, from the lowest parts of these boilers, a quantity of water determined; suppose equal to between twenty and thirty per cent of that evaporated, which latter they state that they have found to be sufficient for the purpose; and assign as a reason for this effect, that if, for example, one quarter of the quantity evaporated be withdrawn at each stroke of the pump, it will be equal to a fifth of the quantity of salt water commonly driven into the boilers to keep up the supply; and as the water of the boiler will ultimately hold four or five times more salt in solution than common sea water, which contains of it about one thirty-second part, the thus withdrawing the quantity mentioned of the highly saline liquor, and replacing it at the same time with water not containing a fourth of the proportion of salt, must take out of the boiler at every stroke of the engine as much salt as is left in it by the steam used in the cylinder for that stroke. And from this the patentees infer, that however long the engine be worked, and at whatever rate of quickness, the water cannot become more salt; by which the evils and inconveniences to which steam vessels have been hitherto subject on long voyages may be avoided, in being obliged to empty and re-fill the boilers every fifty or sixty hours, or incur the risk of their receiving great injury from the deposition of salt within them, besides the loss of fuel, which would be caused by the greater heat necessary to make water evaporate, when so highly impregnated with salt, as it would be towards the latter part of that period.

The heat contained in the saline water withdrawn from the boiler, is, in a great measure, returned back again into it, by the supply-water being passed through a system of pipes or tubes, of extended surfaces, placed in a vessel, into which the hot brine is pumped; which being thus heated by the hot liquor surrounding it, in its passage to the boiler, will have the effect stated of re-conveying that heat to it which would otherwise be dissipated.

If the waters of the ocean contained only common salt, or even no salt that was not of a nature little alterable by being exposed to a high temperature in a metallic boiler, then the method of the patentees for preventing the deposition of extraneous matters in the boilers, would be attended with much efficacy; but, as we learn from accurate analyses of sea water long since published, that it contains also in solution sulphate of lime, carbonate of magnesia, and carbonate of lime, these will soon settle to the bottom, the heat alone being sufficient to precipitate the two latter, which at the same time are strongly attracted to the metal of the boiler, so as to form the hard incrustations which occasion so much trouble. Besides, this incrustation once formed, attracts similar matter as much, or perhaps more, than the metal, so that it accumulates continually; nor is it merely compounded of the earthy deposits mentioned, but more soluble saline matters become consolidated with them, as may be seen in the analyses that have been made of the scales scraped from the bottoms of the boilers in some eminent salt works, which have been found to contain the muriates and sulphates of soda and of magnesia, as well as the sulphate of lime, &c. We also conceive that the sulphate of magnesia and muriate of lime, which are found in sea water will, on the increase of temperature, decompose each other, and deposit sulphate of lime.

Even with fresh water, which does not contain near so much earthy matter in solution as sea water, very inconvenient incrustrations are formed in steam boilers. We know of an instance where for many months large quantities of potatoes were put into the boiler of an engine, under the idea that their mixture with the water would prevent the deposit from adhering so firmly to the boiler as before; but as the boiler was taken out twice in about one year, to have its bottom pieced, their effect was probably not very favourable.

We do not mean to infer, however, that the plan of the patentees will be of no use; on the contrary, we think it will tend very much to diminish the evil, though it will not totally remove it; and though it will not supersede the necessity of cleaning out the boiler, yet it will most probably very much lessen the frequency of that troublesome operation.

A cotemporary journal, in giving an account of this patent, states that sea water contains thirty-two parts per cent of salt, and that it will ultimately attain, in the boiler of a steam engine, a degree of saltness equal to 4.32 or 5.32; which latter is no less than sixteen times and a fraction more than the first quantity.

Now, as it is well known that more than one part of sea salt cannot be dissolved in three parts of water, whether hot or cold, the patentees are by that journalist exposed to the imputation of asserting the gross and absurd impossibility that brine may be boiled down to a strength in which it will contain a quantity of salt nearly four times the weight of the water, or more than fifteen times more than it could hold, as all salt above the quantity of about thirty-three per cent. mixed with it must crystallize.

This error of the journalist is the more inexcusable, as the patentees have expressed, in their specification, the proportion of salt contained in sea water, as we have done, in words at full length, and not in cyphers.

Patent granted to John Malam *of Wakefield, Engineer, for a new mode of applying certain materials hitherto unused, for the constructing of Retorts, and for improvements in the other parts of Gas Apparatus.* Dated August 18, 1823.

The patentee states, in the commencement of his specification, that earthenware retorts of a large size for gas works, cannot be procured from the potteries without great risk of being broken in the carriage; he has therefore contrived to construct them in the following manner. Three arched walls of fire bricks (or more according to the length of the intended retort) are to be erected, at equal distances from each other, over the site of the fire-place; their tops are to be made level, and thin boards are to be laid over them to the breadth and length of the intended retort; on these boards a layer of the composition for the retort is to be beaten down and levelled to the thickness of five inches, as long and broad as is necessary for the bottom of the retort; over this bottom a wooden mould of the shape of the upper part of the retort (which in the drawing is represented as having a semicircular section transversely) is to be placed, and over this mould the composition is to be worked as before to the same thickness, and united well with the bottom, leaving a flanch all round the mouth, according to the drawing, most probably to give greater strength to that part. The side walls, and that of the far end, are then to be built up, leaving several narrow openings in the side, five or six inches high, at a level with the flue, and an arch is to be turned over the retort at a proper distance above it, for the circulation and passage of the flame and smoke from below; and an aperture is to be made in this arch, near the front, for a passage into a flue that runs over its top horizontally backwards (according to the drawing) and leads to the chimney. As soon as the retort is dry enough, the inside mould is to be taken out, and a temporary wall is to be raised before the mouth of the retort, having passages from the fire-place, and to the flue, with an aperture at the bottom for putting in the fuel, which, although expressly stated to be coals, are directed to be burned on the floor or hearth of the fire-place, being kindled at the top, and supplied with air through the narrow apertures left in the bottom of the side walls. A fire is now to be kindled below, and the door of the fire-place to be closed, and the heat to be increased gradually till the retort is properly baked and fit for use; after which the temporary wall at the mouth of the retort is to be taken down, and the front is to be built up as is most suitable for securing the stopper of the retort and the door of the fire-place.

The composition for making the retort is to be made of ten bushels of pulverised fire-stone, such as is found at Thorncliff near Sheffield, with which from 20 to 30 lbs. of red lead are to be well mixed, and to be worked up into a stiff paste with a sufficient quantity of bullock's blood, and then 20 bushels of common fire-clay are to be added, and the whole to be brought to a due consistence for the work in the usual manner.

The improvements in the other parts of the gas apparatus, mentioned in the title, consist first of an arrangement of the gas purifiers, and of a contrivance by which each of them can be in their turn detached from the rest of the apparatus, in order to be cleaned out and have the purifying ingredients renewed, while the gas passes through the rest successively; and, secondly, of a method of making the gas-holder ascend and descend evenly, without inclining more to one side than to another.

The gas purifiers are four in number in the drawing: they may be either square or cylindrical cases, in which a number of trays are placed one above another with small intervals between them; and having bottoms formed like sieves, on which are placed, in layers of a proper thickness, the purifying materials, which are stated to be either slacked lime, pearlash, or "*breeze;*" a tube conveys the gas into the lower part of one of these cases, which then passes in succession through the materials on each of the trays, and goes out at the top through another tube; the two tubes, from the top and bottom of each case, bend round, and ascend near one another through a cylindrical vessel holding water, placed in the centre of the four cases; above this vessel of water, another similar vessel is inverted, having in it several vertical partitions passing from the circumference to a tube in the centre, all of which but one are closed by a horizontal partition at top, above which is a vacant space between it and the top of the vessel; through the centre of the water vessel, two other pipes ascend, one of which is enclosed in the other in the part which passes through the vessel; one of these last pipes serve for conveying the gas from the retort, and the other for carrying it, after being purified, to the gas-holder; round these central pipes, the eight others, from the four cases, are arranged at equal distances, and the divisions in the upper vessel are so placed, that each of three of them may cover the tops of two of the eight pipes; a fourth division covers the top of a single pipe, or the seventh, and the eighth pipe remains uncovered; and by raising the inverted vessel, by a screw and winch prepared for the purpose, and turning it round a fourth of a revolution, the pairs of pipes will be passed into divisions different from those in which they were before, so that in their turn they will come into one of the divisions from which there is no passage to the central tubes, and the communication being thus cut off between the purifying case to which they belong, and the retort and gas-holder, the trays may be taken out of it, cleaned, and after having fresh materials put in them, may be again replaced, and the case be again closed up air-tight fit for use.

The gas, after entering the central pipe in the water vessel (where the water serves the purpose of closing the connection between it and the divisions of the upper vessel, so as to prevent all passage but in the required direction) passes by an aperture in one of the vertical partitions of the upper vessel, and by one of the eight tubes into the bottom of the case where the ingredients have been longest, next to that which is separated to be cleaned out and renewed; from thence, after passing through the purifying materials, it goes back through the water vessel into another division of the upper vessel, then descends again, and goes into the next case, where the materials are in the first state of impurity, after traversing which, it again passes through the water vessel by the pipe belonging to that case, into the third division of the upper vessel; and from thence it goes down again and enters into the bottom of the fourth case, in which the materials have been renewed last; and, after passing through its trays and their contents, enters a third time the upper vessel through the lower one, where the division opens into the upper space of that vessel; and from thence it goes down through the second central pipe, which conveys it to the gas-holder.

Another apparatus, on the same principles with this last, and for the same purpose, is next described in the specification, which is intended for vessels on a smaller scale. In this the four cases for the trays are united in one circular vessel, over which is a water vessel like that described, with an inverted vessel above it similar to the other one, by means of the divisions of which, the gas passes from the retort successively through the cases to the gas-holder, as before: and which upper vessel may be shifted like the other one, in order to detach one of the cases from the apparatus, to have its trays cleaned, and fresh materials put in them, as in the plan first described.

The contrivance for keeping the gas-holder steady and level, as it ascends and descends, which forms the second of the improvements in the gas apparatus, consists of four horizontal axles placed at its top, that meet in its centre, their other ends passing a little beyond its sides at equal distances from each other; at their extremities next the centre, each has a vertical bevelled wheel fixed to it, which works in the teeth of a horizontal bevelled wheel fixed at the centre of the top of the gas-holder, and each of their other ends has a pinion on it, which works in a vertical rack, placed close to one of the four pillars which support the system of weights, pulleys, and chains, by which the moveable part of the gas-holder is balanced in the usual method; by this arrangement of the wheels, axles, racks, and pinions described, no one of the wheels can turn without giving motion to all the rest at the same time, which causing the four pinions to work at once in the four vertical racks, placed at equal distances round the gas-holder, must cause its ascent and descent to be performed without admitting any lateral inclination or inequality of position.

The method of making the retort, described in this specification, seems likely to cause it to be baked very unequally, from the arched walls that support it intercepting the fire from it in those parts where they come in contact with it, and from its top being so much more removed from the heat than its bottom, which circumstance would probably make it very liable to crack when in use.

Earthenware retorts, particularly when of the great thickness described by the Patentee, appear also objectionable on account of the great quantity of coals which they require to heat them; on the other hand, iron retorts cause great expense from their short durability; so that, perhaps, where coals are cheap, the earthen retorts may be preferable.

The singular method of burning the coals without any grate, used by the patentee, seems contrary to all good theory and experience on the subject.

His apparatus connected with the gas purifiers, however, appears to be very ingenious, as is also the machinery for keeping the gas-holder level in its ascent and descent.

Patent granted to WILLIAM HENRY JAMES, *of Coburg Place, Winson Green, near Birmingham, Engineer, for improvements on railways, and in the construction of carriages to be employed thereon.* Dated March 5, 1825.

THE patentee claims, in his specification, the use of longitudinal shafts placed beneath *all* the carriages moved by the locomotive engine, which shafts are so combined with intermediate machinery as to act on *all* the wheels that support these carriages. He claims also the application of universal joints to those shafts, to enable the carriages to turn, while the rotatory motion of the shafts is continued: and he moreover claims the employment of wheels on the carriages divided across their rims into two or more portions, of different elevations, so as to have the effect of so many wheels of those various diameters, and in having railways constructed at their turnings in a similar manner, or in steps of different heights, both which he supposes will facilitate the turning of the carriages.

The machinery that connects the above shafts with the wheels consists of a horizontal wheel, with teeth on both surfaces, which thus performs the office of two wheels, the uppermost of which is acted on by a pinion on the shaft, while the lower one acts on a pinion attached to the axle of the carriage. These wheels and pinions are inclosed in a case, through the sides of which the shaft passes; and a set of them are represented at each pair of wheels, by which means all the wheels in the train of carriages will be made to act on the rails by their friction, so as to assist in the locomotion.

The patentee, in the universal joints which he directs to be employed with these shafts, uses the addition of a small frame of four equal sides, jointed at its four angles, which is connected by one of the joints directly to one portion of the shafts, while its joint at the opposite angle is traversed across its pivot by a small gudgeon, the ends of which turn in the opposite extremities of a semicircular

projection from the next portion of the shafts, which gudgeon, thus forming a joint at right angles to that at the opposite angle of the small frame, constitutes with it a universal joint, or one which will communicate the rotatory motion of one portion of the shafts to the next portion, after they are placed so as to form a considerable angle with each other.

Shafts have been used with locomotive steam-engines, and are described in specifications of patents for carriages on this principle prior to the date of this patent; so that it is only the use of such shafts in conjunction with universal joints that forms the novelty in this instance, unless we call having teeth on both sides of the horizontal wheel a novelty, which is used in conveying motion from the shafts to the wheels of the carriages.

Dividing the rims of the wheels into rings of two or more different elevations, would, in fact, be the same as adding so many different rims to them, and must increase their weight in proportion; which so far would be a drawback to any advantage that might be gained by them in facilitating the act of turning. We also conceive that shifting the wheels from one rim to the other on the turnings of the rails, would be both a troublesome and tedious operation; and for the mode of its performance the patentee has omitted to give any instructions.

The steps proposed on the rails at the turnings, so far as any of them would be concerned in causing the wheels at one side to move in larger circles, could have so little effect in this way, that they could in no respect compensate for the additional expense which their formation must occasion.

Patent granted to Samuel Brown, *of Saville-row, Burlington-street, Middlesex, Commander in the Royal Navy, for giving motion to vessels employed in inland navigation.* Dated March 15, 1825.

The object of this patent is effected by laying down chains at the bottom of the canal, river, lake, or other situation where the navigation is employed, extending either from one extremity of them to the other, or for any other convenient distance; which, in the case of canals, may be from lock to lock.

These chains are to be made fast at each end in any effectual manner, and are to be used for giving motion to the boats or other vessels, by passing round a vertical wheel, either placed on a davit before the stem, or over the bow of the one to be impelled, which wheel is to be turned, by means of another on the same axle with it, which receives its motion by a band from a third wheel in the internal part of the vessel, that is ultimately turned round by a steam-engine. These three wheels have grooves round their rims, so inclined as to gripe the chain or band that works in them; and they may be made also to hold chains fast, by having cavities cut at their inner faces corresponding to the links of the chains.

As the chain is drawn up from the canal by the wheel in front, it is passed down again into it at the other side of the wheel, so that but a small portion of its weight is supported at any one time by the vessel.

Two boats may be made in this manner to move in opposite directions by the same chain, it being only necessary to have it regulated by those of competent authority, which boat was to retain the chain when the two met (which would probably be that approaching the capital, or other large city or town), when the men in the other boat would have to throw off the chain from the wheel, and grapple it up again after passing.

The engine-boat drawing itself forward in this manner might be made to tow others after it, the number of which would depend on the power of the steam-engine. In the drawing, two boats are represented, towed in this manner by the engine-boat, and steered by a man at the helm in the *last* of the three.

This method of moving boats by steam-engines would be superior for canals to any in which paddles were used for the purpose, as the great impulse which these would give to the water (of which we may often see dangerous specimens in the rivers where steam vessels pass), could not fail to do great damage to the banks, and much increase the expense of cleaning their beds, and keeping them in repair; while, by the plan of the patentee, no more injury could be caused than if the boats were drawn by horses, and in some cases not so much.

It is evident that two chains laid in the way proposed, one for the boats coming in, and the other for their going out, would save much time by rendering the shifting of the chain, directed on two vessels meeting, unnecessary; and would be advisable on canals on which there was much trade.

The representation in the drawing of the man who steers as being in the last of the three boats, is an oversight we should not have expected from a naval commander; as it is evident a man so placed could not prevent the first boat from running aground, or direct its movements in any respect whatsoever.

FRENCH PATENTS.

Brevet d'Invention, for fifteen years, granted to M. ETIENNE DATE, *for certain processes, which have principally for their object the employment of copper in making colours, or in the preparation of several well-known products of art, such as sulphate of copper, soda, &c.* Dated September 25, 1807.

Processes by which new colours for painting are produced, or the fabrication of those already known ameliorated.

MURIATED GREEN.

THIS green is obtained by two methods. The first consists in separating the muriated oxide of copper from the metal, and from the soluble salts which accompany it. This product, dried in the air, or at a mild heat, in convenient forms, is the muriated green. In this state it gives a green that is of little depth in distemper water colours, but which has a very beautiful tint for oil painting; it is entirely unalterable by the sun or the air.

If this green is washed less completely, the muriate of copper which it retains gives it a much more rich colour.

The second method consists in wetting a fit oxide of copper with liquid muriate of copper, and leaving these substances in contact until the simple oxide of copper is converted to the *muriated oxide.*

MURIATED GREEN MIXED WITH ALUMEN.

Separate the oxide of copper from the undissolved muriate of copper, and from the soluble salts; in this state you will have the muriated green mixed with alumen; it is, in truth, a little pale, on account of the large quantity of alumen which is united to it; but it may, nevertheless, be used as a colour for painting, in certain cases, with a view to economy. If, in the fabrication of oxide of copper mixed with alumen, a part of the alumen be suppressed, and be replaced by a proportional quantity of sulphate of copper, a green muriate of copper, mixed with alumen, will be obtained, of a colour much more intense, and of a tint which may be regulated at pleasure, by the proportion between the muriated oxide of copper and the alumen, and at the same time the advantage will be obtained of combining the unalterable muriated green with the alumen, which is known to be an excellent ingredient of colours.

SULPHATED GREEN.

Pour upon sulphate of ammonia and solid copper, a certain quantity of sulphate of copper; leave these substances in contact until the action which you have in view be terminated. Then separate the liquor from the precipitate, which, being duly washed, is a sulphated oxide of copper, or sulphated green.

In giving to this sulphated green a liquid mixture of sulphate of copper and sulphate of ammonia, a primary material is produced for the fabrication of oxide of copper, and for that of sulphate of ammonia.

It is to be observed, that in this process all the ammonia separates to form sulphate of ammonia. By this means a quantity of the oxide of copper will be precipitated, which, coming in contact with the undecomposed sulphate of copper in solution, will become sulphated oxide, and these two quantities of sulphated oxide of copper form the insoluble sulphated green.

DIFFERENT COLOURS FOR PAINTING.

From proper oxides of copper, treated on the foregoing principle, may be procured colours for painting.

Colours are moreover obtained by uniting the triple combinations produced by salts having a base of ammonia, with sulphate of copper. All the ammonia contained becomes changed into different binary compositions, which, for the most part, may be used as colours for painting.

CARBONATED GREEN.

Use the two following methods instead of the common processes :—1st, On the muriated oxide of copper pour cupreous ammonia, obtained as will be hereafter explained. Leave these two substances in contact until the muriated oxide is changed into the carbonated oxide, which, separated from the liquid, is a handsome carbonated green.

The cupreous ammonia, with an excess of carbonate of ammonia, is formed by treating it with the muriated oxide of copper. The carbonic acid becomes combined with the oxide of copper, and this yields the muriatic acid to the ammonia. The liquid separated being still muriate of ammonia and cupreous ammonia mixed, will serve usefully for the preparation of oxides of copper and ammoniacal salts proper for triple combinations.

2d, Precipitate the soluble muriate of copper by carbonate of lime, and you will have a pretty carbonated green.

The liquor which lies above it contains muriate of lime, useful in composing muriate of ammonia and muriate of barytes, for the fabrication of soda.

Precipitate the same soluble muriate of copper, or any other solution of copper, by carbonate of ammonia. Leave these substances for some time exposed to the air; separate them afterwards, and you will thus obtain carbonated greens, of which some will be very beautiful.

ARSENICATED GREENS OBTAINED BY WETTING.

Pour liquid arsenate of ammonia, with a proportion of the base suitable to the tint which you wish to obtain, on a fit quantity of oxide of copper. Shut up these substances in well covered vessels; stir them up from time to time, until the simple oxide has become arsenicated oxide of the desired shade. On then separating the green mass from the liquor, an arsenicated green of the required tint will be obtained, and an ammoniacal liquor, which may be employed to make cupreous ammonia, or for any other use in which ammonia is wanted.

In this process, as well as in the following ones, the combination is effected by simple affinity. The arsenicated green may be of every shade, and it is the arsenical acid alone that becomes combined, the ammonia only serving to facilitate the union of the arsenical acid with the oxide of copper, in rendering it more soluble and liquid. This method of making, by simple and direct affinity, compositions which at present are only made by double and complex affinities, is susceptible of many other very useful applications, such as the fabrication of some prussiates and sulphurets.

By treating with the same arsenate of ammonia sulphate of ammonia, and solid copper, in the manner already shown, the latter is changed into a beautiful arsenicated green.

The same takes place in treating in the same manner all the triple compounds.

In substituting the arsenate of potash, or that of soda, for the arsenate of ammonia, and treating in the same manner either the oxides of copper, or the muriated oxides of copper before-mentioned, eight modifications may be produced, which will all give very beautiful green arsenates of any shade desired.

ARSENICATED GREENS OBTAINED BY PRECIPITATION.

By precipitating a solution of copper, made with any acid, with the same arsenate of ammonia, and separating the precipitate from the liquor, and washing it, will be produced,

1st, An arsenicated green, of every shade and degree of beauty. 2dly, A liquid, an ammoniacal salt in solution, which may be used in making triple compositions.

By dissolving the white oxide of arsenic in warm muriatic acid, and adding sufficient water to prevent the crystallization, and by treating the liquor with cupreous ammonia in due proportion and manner, and with the quantity of oxide of copper necessary to saturate the excess of muriatic acid, and to produce a just proportion between the oxide of arsenic and the oxide of copper, there will be obtained the arsenicated green, a liquid muriate of ammonia, and all the ammonia employed.

By substituting for the free muriatic acid a mixture of white oxide of arsenic, muriate of soda, and sulphuric acid, diluted sufficiently with water, and making the mixture boil, and managing it as shown in the article on carbonated greens, the same products will be obtained.

In this process, which is more economical than the preceding, there is formed, in the mixed acid, the *arsenico-muriate*, a triple salt, which may be separated from it at pleasure by crystallization, and which, left in the mixture, will do no injury to the use made of this latter. This salt will be made known on another occasion.

GREEN ACETATES ANALOGOUS TO THE DIFFERENT SORTS OF VERDIGRIS OF COMMERCE.

Different methods are employed, according to the materials used.

Acetous acid is to be made, and to be distilled in an economical manner. In this acid any convenient oxide of copper is to be dissolved, such, for example, as that obtained from the soluble muriate of copper, by precipitating it with lime. This solution is to be made to crystallize, and crystallized acetate of copper, or green acetate, will be obtained, and a weaker solution of the same acetate.

To obtain the oxide of copper necessary for this preparation, employ a part of the soluble acetate of copper and of the liquor obtained by the preceding method; wet with it one of the oxides of copper; treat this mixture according to the foregoing principles and method, and you will have a green acetate, analogous to the common verdigris of commerce, but exempt from the foreign substances which are always found in the latter.

Wet with the same acetate of copper in solution which has been mentioned, the acetate of copper and of ammonia, which you form in treating the copper by the acetate of ammonia; combine the substances as has been mentioned in the article *Sulphated Green*, and you will also obtain a green acetate, similar to the verdigris of commerce, and a liquor, which, mixed with the acetate of copper and the acetate of ammonia, serves to make new quantities of acetate of ammonia and of copper.

BLUES FOR PAINTING ANALOGOUS TO THE CENDRES BLEUES OF COMMERCE, AND TO PRUSSIAN BLUE.

The sulphate of ammonia and of solid copper, like many triple compounds, are of a very pleasing light blue, capable, by employing them properly, of serving as colours.

By precipitating the liquid muriates of copper (for example, the green muriate which was mentioned in the beginning of this memoir) with lime, and treating this precipitate with lime, the *cendres bleues* of Pelletier will be obtained, and a muriate of lime, useful in making muriate of ammonia and muriate of barytes, intended for the fabrication of soda.

By precipitating the cupreous ammonia, described further back, with fixed caustic alkali, a beautiful light blue is obtained, capable of being made still more handsome. Distillation will return the two alkalies employed.

In many operations are obtained liquid mixtures of oxides of copper and ammoniacal salts, too much diluted with water to be evaporated economically. By treating these liquids with lime, they become triple saline compounds, with a great excess of ammonia. In pouring these new liquors on oxide of copper, to saturate the ammonia, a mixed solution is got, which, treated properly, and in just proportion, with soluble muriate of copper dissolved, gives precipitates capable of being used as blue in painting, particularly when improved by lime.

From animal charcoal, obtained in making ammonia, prussic acid may be procured, which may be used in the fabrication of prussian blue.

RED BROWNS AND OTHER COLOURS FOR PAINTING, FORMED BY OXIDE OF IRON.

By exposing to a proper degree of heat the oxide of iron, which is procured without expense, and in large quantities, by the manner of making sulphate of ammonia which will be stated further on, the different colours mentioned will be obtained.

To be continued.

Brevet d'Invention for five years, granted to M. Grignet, *of Paris, for a process for the preparation of turf.* Dated March 22, 1817.

This preparation consists in plunging the turf for some hours into common milk of lime, diluted with a sufficient quantity of water; care must be taken to draw the turf out before it is entirely saturated, and to submit to a strong pressure in a simple lever press (contrived by M. Grigaret), which consists of two levers, one placed beneath the other, and connected with it by a piece jointed to both, and so arranged as to act on it at a distance from its centre of motion, and multiply its power.

The upper lever is sufficient for pressing the sods of turf, when freshly cut; if, on the contrary, they have been previously dried, then the lower, or compound lever, must be used.

Brevet d'Invention for five years, granted to M. Cadet de Vaux, *Paris, for a process by which the fat may be extracted from the bones of horses.* Dated October 24, 1815.

The bones of horses, after the flesh being taken off, are plunged into boiling water, to accelerate the formation of the fat, or more commonly are left exposed to the free air for a period of time, longer or shorter, according to the degree of temperature, which, however, only varies from ten to forty days. After this time it is known by the colour of the bones, that the albuminous matter, which occupies the place of the marrow, has passed into the state of fat; then the bones are broken and submitted to the action of boiling water, and what rises to the surface is collected.

LIST OF NEW PATENTS.

AUGUSTUS COUNT DE LA GARDE, of Saint James's-square, Middlesex, for improved machinery for breaking or preparing hemp, flax, and other fibrous materials.—Communicated to him by a foreigner.—Dated November 24, 1825.—Six months to enrol specification.

JOSEPH EVE, of Augusta Georgia, America, now residing at Liverpool, engineer, for an improved steam-engine.—Dated November 24, 1825.—Six months to enrol specification.

HENRY KING, of Norfolk-street, Commercial Road, Middlesex, master mariner, and WILLIAM KINGSTON, of the Dock Yard, Portsmouth, master millwright, for improved fids for topmasts, gallant masts, bowsprits, and all other masts and spars to which the use of the fid is applied.—Dated November 26, 1825.—Six months to enrol specification.

RICHARD JONES TOMLINSON, of Bristol, Gentleman, for frame-work for bedsteads and other purposes.—Dated November 26, 1825.—Six months to enrol specification.

MARC LARIVIERE, of Princes'-square, Kennington, Surrey, mechanist, for certain apparatus or machinery to be applied to the well-known Stamp's fly presses, or other presses, for the purpose of perforating metal plates, and for the application of such perforated metal plates to various useful purposes.—Dated November 28, 1825.—Six months to enrol specification.

William Pope, of Ball Alley, Lombard-street, London, mathematician, for improvements on wheeled carriages.—Dated December 3, 1825.—Six months to enrol specification.

The same, for improvements in making, mixing, compounding, improving, or altering the article of soap.—Dated December 3, 1825.—Six months to enrol specification.

Henry Berry, of Abchurch-lane, London, merchant, for an improved method, in different shapes or forms, of securing volatile or other fluids, and concrete or other substances, in various descriptions of bottles and vessels.—Dated December 3, 1825.—Six months to enrol specification.

Ezekiel Edmonds, of Bradford, Wilts, clothier, for improvements on machines for scribbling and carding sheeps' wool, cotton, or any fibrous articles requiring such process.—Dated December 3, 1825.—Six months to enrol specification.

John Beever, of Manchester, Gentleman, for an improved gun barrel.—Dated December 3, 1825.—Six months to enrol specification.

Edmund Luscombe, of East Stonehouse, Devon, merchant, for a method of manufacturing or preparing an oil or oils extracted from certain vegetable substances, and the application thereof to gas light and other purposes. Partly communicated to him by a foreigner residing abroad.—Dated December 6, 1825.—Six months to enrol specification.

John Phillips Beavan, of Clifford-street, Middlesex, Gentleman, for a cement for building and other purposes. Communicated to him by a foreigner.—Dated December 7, 1825.—Six months to enrol specification.

FRANCIS HALLIDAY, of Ham, Surrey, Esq. for improvements in machinery to be operated upon by steam. —Dated December 9, 1825.—Six months to enrol specification.

JOSEPH CHESSEBOROUGH DYER, of Manchester, patent card manufacturer, for improvements in machinery for making wire cards for carding wool, cotton, tow, and other fibrous substances of the like nature; and also certain improvements on a machine for shaving and preparing leather used in making such cards.—Dated December 9, 1825.—Six months to enrol specification.

ROBERT ADDAMS, of Theresa Terrace, Hammersmith, Middlesex, Gentleman, for a method of propelling or moving carriages of various descriptions on turnpike, rail, or other roads.—Dated December 14, 1825.—Six months to enrol specification.

MATTHEW FERRIS, of Longford, Middlesex, calico printer, for improvements on presses or machinery for printing cotton and other fabrics.—Dated December 14, 1825.—Six months to enrol specification.

JAMES ASHWELL TABOR, of Jewin-street, Cripplegate, London, Gentleman, for means for indicating the depth of water in ships and vessels.—Dated December 14, 1825.—Two months to enrol specification.

THE

REPERTORY

OF

PATENT INVENTIONS, &c.

No. VIII. FEBRUARY, 1826.

Specification of the Patent granted to John Fussell, *of Mells, in the county of Somerset, Edge-tool-maker, for an improved method of heating woollen cloth, for the purpose of giving it a lustre in dressing.* Dated August 11, 1824.

TO all to whom these presents shall come, &c. *Now know ye*, that in compliance with the said proviso, I, the said John Fussell, do hereby declare that the nature of my said invention of an improved method of heating woollen cloth, for the purpose of giving it a lustre in dressing, and the manner in which the same is to be performed, is fully described and ascertained as follows, that is to say:—My invention consists in an improved method of applying steam to the heating of woollen cloth (that is to say):—After the cloth is properly dressed, either by gig machine, or by hand dressing, I roll it upon a hollow roller or rollers, so contrived as to receive or enclose the list or forrel, by which process the stains or wrinkles which are usually produced by rolling the cloth upon the solid roller or rollers in common use, are avoided. I then place the cloth on end, for the purpose of shifting as much of the water as is usually shifted previously to racking. In the next place I submit the cloth to the action of steam for about three hours, more or less, according to circumstances, either by suspending it over water in a common furnace, or by placing it in any apparatus contrived for the purpose, and capable of receiving one or more rolls of cloth at a time, or by any other convenient and suitable means, in which steam is, or may be, raised in the usual ways, or conveyed into it from a detached or separate generator, and applied to the cloth; or if desirable, the steam may be introduced into the roller or rollers, care being taken to prevent the cloth from being stained by the condensed steam from the forrel. The proper temperature of the steam to be applied to the cloth may be stated at considerably below the boiling point; but the exact temperature must be regulated by the judgment of the operator, according to the lustre required, and in some measure also to the capability of the colour to withstand a high moist temperature. When it is desirable to give to the cloth a very high lustre, it may be obtained by shifting less of the water than is usually shifted previously to racking, and raising the steam to a greater degree of heat than required to produce a less degree of lustre. In this case, however, the roller on which the cloth is wound, should be made to revolve slowly during the process of steaming, by mechanical or other means.

In witness whereof, &c.

Specification of the Patent granted to Molyneux Shuldham, *of Brampton Hall, Wrangford, in the county of Suffolk, Lieutenant in the Royal Navy, for certain improvements for the purposes of setting, working, reefing, and furling the sails of boats, ships, and other vessels.* Dated July 8, 1825.

WITH TWO PLATES.

TO all to whom these presents shall come, &c. &c. *Now know ye,* that in compliance with the said proviso, I, the said Molyneux Shuldham, do hereby declare that the nature of my said invention, and the manner in which the same is to be performed, are particularly described and ascertained in and by the drawings hereunto annexed, and the following description thereof, (that is to say):— The chief objects of my said improvements in the setting and working the sails of boats, ships, and other vessels, are the saving and reducing of manual labour, and of the running rigging, and the consequent wear and tear thereof; and which said objects I effect, by causing the sails connected with the masts to turn altogether upon necks and pivots, made at the lower end of the masts as centres, and which said necks move in collars, affixed and secured to the beams of the boats, ships, or other vessels, whilst the pivots turn in steps or pivot holes, secured to their keelsons. The turning or moving of the masts and sails may either be effected by the action of the wind upon the sails, or by manual labour, or by both conjointly, and the quantity of their motion may be regulated or limited by employing tackle properly fitted for the purpose. In order, however, to render the explanation of the various methods in which I carry my said improvements into effect more intelligible, I shall proceed to refer to the different figures contained in the drawings, which, as aforesaid, are annexed to this specification, and in all of which figures, the same letters and figures of reference, indicate the similar parts. In drawing No. 1, (Pl. V.) A, figs. 1, 2, and 3, represents a mast: B the neck of it, turning in a collar, C, affixed in the beam or thwart of a boat, D: E, the pivot, moving in a step or pivot hole, F, secured to the keelson, G. For the sake of strength, I form the shaft or lower part of the mast, A, and the neck and pivot upon it, of wrought iron, or other proper metal or compositions of metal, and unite or connect it with the upper or wooden part of the mast, by letting it in, and securing it firmly by driving hoops of metal over the place of juncture. H is the boom, turning upon a pin passed through holes made in the shaft, and in a piece of metal, I, affixed to the boom, H, and secured therein, either by a screw and nut, a fore-lock, or other proper means. By this contrivance the boom can be turned upon the pin, and brought parallel with the mast, for the convenience of stowing it in the least compass. J is the yard, either hoisted by a halyard, passed through a shieve hole, K, made in the head of the mast, as shown; or by means of a block fixed to the mast head; and which halyard is belayed to a cleat, L, affixed to the mast. M the sail, laced both to the yard and boom: N the sheet, affixed to the boom, and passed through the block, O, which is affixed amidships, and is then belayed to a cleat. Fig. 2 represents the mast as unstepped, the boom turned nearly parallel to it, and also the yard and sail ready for furling the latter, as shown in fig. 3. Having thus described the simplest construction and application of my said improvements, I shall next proceed to give an example of another construction, shown in fig. 4 of drawing No. 2, (Pl. VI.) which is an elevation of a lug-sail boat; and in fig. 5, which is a plan of it. In this construction I affix a cross, P, formed either of wood or metal, upon the head of the shaft or upright axis, A, (not shown in these figures); the two pieces forming the cross being placed at angles of about 79° and 108°, the boom, H, being fixed between the wide openings in the cross, as shown in fig. 5. Instead of an ordinary mast from each end of the cross, a pole, Q, ascends, and which are all four firmly united at top to a mast head, R, they being let into stop grooves made around the lower end of it to receive them, and are all securely bolted and rivetted together; in addition to which, an angular iron plate may be occasionally affixed to each side in the same manner, in order to strengthen it still more. The four poles, Q, have shoulders and tenants formed at their other ends, which are let into mortice holes made in the ends of the cross to receive them, and are secured underneath the cross by pins, driven through holes made in the tenants. The points of union at the ends of the cross may also be further strengthened by the introduction of iron or wooden knees, in case the increased bulk of the parts require it, and as will be described hereafter. These poles, so united, form my open quadrangular pyramidal mast. J is the yard, hoisted as already described, and M is the sail. I work this sail in the following manner:—A grooved wheel is affixed underneath the arms; in the angular groove round this wheel an endless rope, S, is lodged, which is passed through the blocks, T T, affixed to the gunwale of the vessel at a sufficient height for the men to work it. By this contrivance the vessel may be wore without the necessity of jibbing the sail; but in tacking or working to windward, the sail must be held by a sheet affixed to the boom, as before described, and be allowed either to act of itself, or be moved by hand. Fig. 6 exhibits a different form of an open quadrangular pyramidal mast, calculated for a latteen sail, the poles, Q Q, being inclined forwards, to balance the yard and boom the better. The yard, J, and the boom, H, are united at their fore-ends by a pin or bolt, passed through holes made for the purpose, and secured by a fore-lock. Fig. 7 exhibits an elevation of what I term my open triangular pyramidal mast; fig. 8 a plan of it; and fig. 9 the same as fig. 8, but with the sails set. Here the arms of the cross, P, are placed at right angles to each other, and two of the three poles, Q Q Q, are let into mortice holes made on each side, in the ends of the cross, while the third is passed through a hole made in the boom, H, or lengthened arm of the cross, P. U U U U, figs. 7 and 8, are four strengthening braces affixed to each end of the boom, and to the two side poles; the fore and aft pieces forming the boom, H H, are scarfed to two of the arms of the cross, P, and are firmly bound by hoops. They also rise up at each end, as shown in figs. 7 and 9, in order to prevent the sails from dipping into the water when sailing before the wind. The topmast is joined to the upper part of the fore pole, Q, by the two caps, V V, in the usual manner, and is furnished with a cross tree or spreader, and the fore pole is united to the two side poles by means of an angular wooden block, W, with two stopped grooves in its sides, to receive the ends of the two side poles, and a third groove for the fore pole to lie in; the whole being also firmly bolted and hooped together. These open triangular pyramidal masts, are adapted for cutters, schooners, sloops, and many other descriptions of fore and aft rigged vessels. In fig. 9 the sail, X, partakes of the nature both of a mainsail and a foresail, the fore leech being attached to the fore pole by hoops, in the usual manner. It is also hoisted and set as usual, by means of a gaff, Y, as is also the gaff topsail, Z. The jib may either be an ordinary one, such as is commonly used in cutters, or, in order that no wind may escape between the jib and the mainsail, I make the jib double, as shown at *a*, by uniting it at the luff, *b*, and the after leech of each jib locks in on each side of the mainsail. This contrivance also enables me to open either side of the double jib by means of blocks, *c c*, fixed on the braces, U U, for the purpose of laying to or paying the vessel's head off. The after braces, U U, answer the same purpose as the topping lifts of the usual cutters, by supporting the after end of the boom. By the complete revolution of the mast and sails, I am enabled to dispense with the squaresail commonly used in cutters when going before the wind. I connect the arms of the cross, P, by four or more sets of bars of wood placed between them, as shown in fig. 8, so as to form an open platform, upon which the coils of running rigging may be lodged. Fig. 10 is an elevation, and fig. 11 a plan, of part of a schooner, intended to show the manner of applying my open triangular pyramidal masts to that species of vessel, the foremast and sails being similar to that last described, but the mainmast differing in not having a jib, and there being no boom before the fore pole. These masts and sails may be worked either by tackles fixed occasionally to the arms of the crosses, or to the booms, or by endless ropes passing round wheels as already described. In case of applying my improvements to vessels of greater burden, it becomes necessary to employ means to afford greater stability or support to the masts and sails than have yet been described. These I carry into effect in various ways, namely, instead of forming the shaft, A, of the mast, of one solid bar of metal, I can construct it of wood and metal, combined in the manner shown in fig. 12 of drawing No. 1, a section of which, on a larger scale, is shown in fig. 13, and a plan of it in fig. 14, which is taken at the dotted line, *d d*, in fig. 13. A is the shaft, having a collar, *e*, at its lower end, and a shoulder, *f*, fig. 13, at the upper part of it, with a screw and nut, *g*, to it: *h* is a block of wood, perforated in its centre to receive the shaft, A, and into it the four upper arms, P P, are let in at top, and the four lower ones, P P, below them. The upper arms are held in their places by means of a metal cross plate, *i i*, having a hole in its centre for the shaft, A, to pass through, and holes in it for bolts and rivets, by which the arms of the upper cross, P P, are secured in their proper situations. The lower arms, P P, are held and supported by metal knees, *j j*, which are affixed to them by bolts and rivets, and which are all enclosed within a metal hoop, *k*. This hoop also embraces and encloses four metal plates, *l l*, &c. within it, which serve to strengthen the wooden block, *h*, between the mortice holes. The plates are carried above, and extend below, and are secured by two other metal hoops, *m m*. Both the knees and the plates are let into the wood of the block. The metal hoop, *k*, also forms the neck of the shaft, which turns in a collar, firmly secured to the beams of the vessel, in a manner to be described hereafter. The boom, H, figs. 12 and 13, lies upon the top of the cross plate, *i i*, the shaft, A, passing through a hole in it, and the whole is firmly bound together by the screw and nut, *g*. The two sets of cross arms, P P, are united at their ends and to the poles (one of which is shown at Q, in fig. 13, and both in fig. 12) by metal plates, bands, or knees, firmly secured to them by bolts and rivets. Another method of constructing the shaft and cross, where still greater strength and stability are required, is shown in elevation and section, in fig. 15, in which A is the shaft, with a collar, *e*, at its foot, and a screw and nut, *g*, at its top; it is enclosed like that last described, in a block of wood, *h*. The shaft and block are inclosed within a cast iron cone, *n*, having a flanch, *o o*, at its upper end, with four open boxes around it, *pppp*, shown in the plan, fig. 16, and in section in fig. 15, into which boxes the lower arms of the cross, P P, are fitted by being halved into each other. Upon these arms the flanch, *q*, of another cast iron cone, *r*, shown in elevation in fig. 17, and a plan of it in fig. 18, is fitted, and the whole are bound together with bolts and rivets. This cone is also filled with a wooden block, *s*. The upper part of the cone, *r*, has likewise a flanch, *t t*, and four other open boxes, *u u u u*, upon it, which receive into them the upper arms of the cross, P P, also halved into each other, and the whole are covered by a plate, *v*, shown in fig. 19, and secured by bolts and rivets. And, lastly, the whole is bound together by the screw and nut, *g*. Cross braces, *w w*, are fixed by bolts to cast iron plates, *x x*, &c. figs. 15 and 17, which are cast around the cone, *r*, and to iron plates, *z z*, at the ends of the arms of the cross, P P, &c. for the purpose of giving additional strength to the cross; the iron plates, *z z*, likewise serving to connect the poles, Q Q, of the open quadrangular pyramidal mast to the cross. The cylindrical part, 1, 1, at the upper end of the cone, *n*, fig. 15, is formed into an axis which turns in a cast iron collar, 2, with a flanch, 3, and which is firmly secured by bolts and rivets to the deck beams of the vessel, as shown in the plan, fig. 20; another cast iron plate, 4, fig. 15, being also united to the flanch, 3, and having a hole in its centre, into which the lower part of the collar, 2, is fitted. This flanch and plate also serve to secure the beams, partners of the mast, and diagonal braces, in their places, the other ends of them being united to the shaft pieces, 5, 5, and breast hook, 6,

Fig. 1.

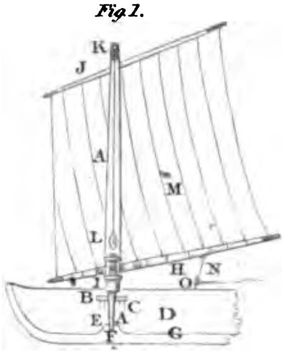
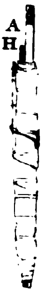


Fig. 3.



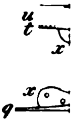


Fig. 2.

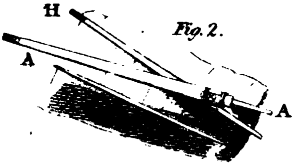


Fig. 49.

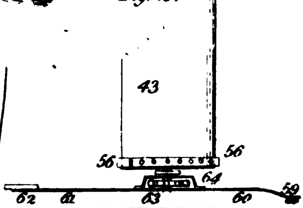
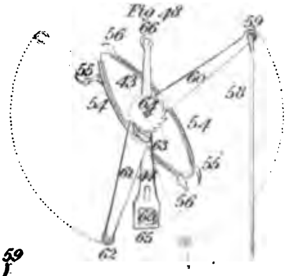
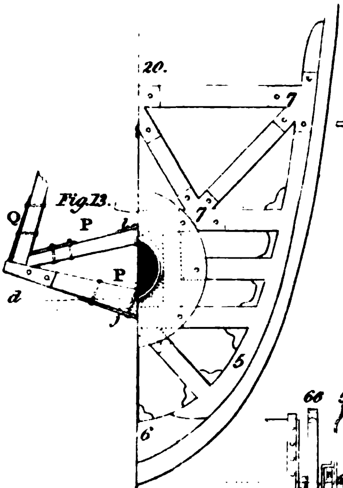


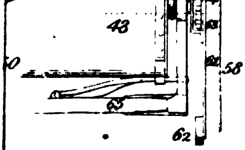
Fig. 48



20.

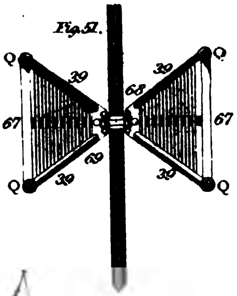
Fig. 23.





Pl. VI. Vol. II.

Fig. 51.



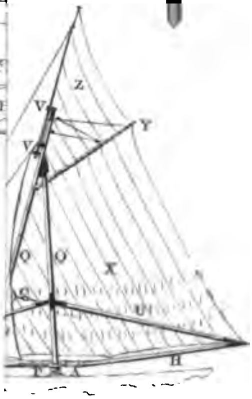


Fig. 8.

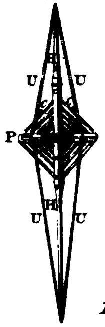


Fig. 11.

Fig. 55.

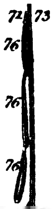


Fig. 54.

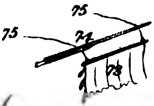
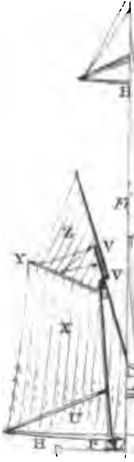


Fig. 31.



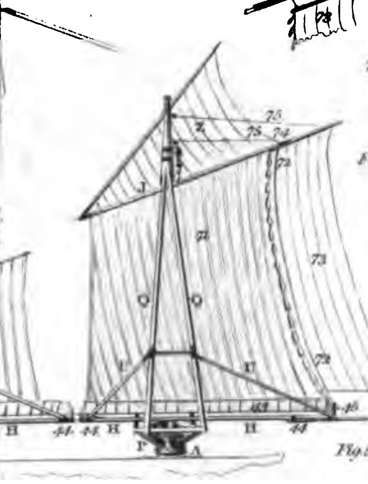


Fig. 56.

Fig. 57.

Fig. 58.

Fig.

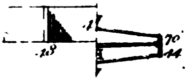
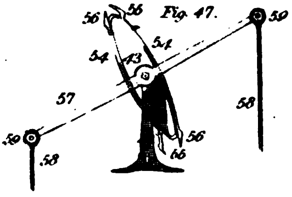


Fig. 47.



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as shown in fig. 20, and which I have introduced for the sake of giving additional support to the mast. 7, 7, &c. are iron plates, intended to unite the ends of the diagonal braces and the beams more firmly together. The pivot, 8, at the bottom of the iron shaft, A, in fig. 15, works in a pivot hole, 9, formed in a cast iron step, which is firmly secured by bolts to the keelson, 10. 11 is a wooden frame or blocks, placed around the step; to steady it yet more, an iron plate, 12, is affixed upon these blocks or frame, having a hole in its centre, which receives the top of the step within it. A casing, 13, of wood, is placed around the shaft, to prevent accidents. In order to hinder the salt or other water from penetrating to the axis, a metal ring, 14, is affixed to the flanch, 3, and another ring, 15, descends from a circular shoulder, made around the upper part of the cone, *n*, serving as a cap or cover to the ring, 14. For the same purpose a kind of roof or cover, 16, see fig. 13, and a ring, 17, is provided in the shaft, A, and which said ring, 17, shuts over the lower ring (similar to that shown in fig. 15, at 14), and surrounds the neck or axis in like manner, as just described. To prevent the shaft, A, from being lifted up or thrown out of the step, 9, (see fig. 15), I either employ a ring or collar, secured by the screws, 18, 18, or some other fit and proper substitute for them. Having thus described some of the modes by which I construct and strengthen the cross and shaft, I shall proceed to show how I give additional support to them, by means of circular rings or sweeps, and friction wheels or rollers, acting upon or against the sweeps. In fig. 21, 19, 19, represent, in section, a flat circular ring or sweep, either formed of wood, covered with a plate or plates of iron, or other proper metal, or of cast iron, and either entire, or in separate parts joined together. This ring is firmly secured to the deck of the vessel, 20, being blocked underneath, where necessary, to preserve its flat or plane upper surface. To each of the four beams, P P, forming the cross, a friction wheel or roller, 21, 21, is affixed on their underside, which may either be mounted as shown, or be let into the substance of the beams so as to project below them, or be secured to the ends of the beams, as will be described hereafter. The shaft, A, may also be lengthened above, as shown, and be surrounded with a block of wood, *s*, to strengthen it; and four braces, two of which are shown at *w w*, may be added, extending from the top of the block, *s*, to the ends of the beams, P P, and be there united with the poles, Q Q, of the open triangular or quadrangular pyramidal masts, by means of iron plates, knees, &c. It would be still better if the upper surface of the metal ring, 19, 19, were to be made conical, and the friction wheels or rollers, 21, 21, also be portions of cones, as shown by the crossing dotted lines, 22, 22, in order to give them a broader bearing, and cause them to wear well. Another method of carrying this part of my invention into effect is shown in section at fig. 22, in drawing No. 2, and a plan of it in fig. 23. Here the friction wheels or rollers, 21, 21, are mounted between metal plates, 23, 23, secured to the ends of the beams, P P, forming the cross, and their rims project above and below those beams. The friction wheels either act above or against the underside of a circular wood or metal ring or sweep, 24, 24; or below upon another sweep, 25, 25, which is parallel to and concentric with the upper sweep, 24, 24, the two sweeps being framed together, and the lower one supported upon blocks, 26, 26, &c. affixed to the deck beams and gunwale of the vessel, and the upper one suspended above it by iron knees, 27, 27, &c. bolted to both sweeps, and secured to the deck beams and gunwale of the vessel, as shown. 28 is a cap, intended to cover the head of the shaft, A, and to keep down the segments of the circular grating or platform, 29. In fig. 24 is shown a different construction of the parts above described. Here there are two sets of crosses, P P, kept at a proper distance apart by the beams, 30, 30, which are placed between them; and the friction wheel or roller, 23, 23, &c. is mounted at the end of each cross, F F; making eight in all. These are better shown in the section, fig. 25. Four of these friction wheels act upon the upper face of a circular sweep, 31, shewn in section, in fig. 26, and the other four against the underside of it. It being difficult, however, to show this combination in these figures, and as I also intend to construct the circular sweep in cast iron, so I shall refer to fig. 27, of drawing No. 1, where the two sets of friction wheels, 23, 23, &c. are shown in contact with the sweep, 31, but without the crosses. Fig. 28 is a plan of fig. 27. Fig. 29, of drawing No. 2, is a plan of fig. 26, as applied to the afterpart of a vessel for supporting the mainmast; and as the circular sweeps and friction rollers assist in supporting the mast, so there is no need to adopt the additional braces round the collar, shown in fig. 20, of drawing No. 1. In adapting my said invention to a brig, I dispense entirely with the bowsprit, and compensate for the loss of the jibs and fore topmast staysail, by placing my foremast farther forwards, and making my square sails the larger. I also dispense with the stay sails. Each mast is left at liberty to revolve around its own centre, independent of and uncontrolled by its neighbouring mast. As the sails act of themselves, or by the power of the wind, in the manner of a windvane, so the necessity of working the yards by braces, and the courses by tacks and sheets, is avoided, except in the cases of hauling up or setting the courses. I also do away with the bow lines. Fig. 24, of drawing No. 2, shows the construction of the open quadrangular pyramidal mast and top mast, as applied to a brig. I would prefer to make each of the poles, Q Q Q Q, forming the mast, of single pieces, whenever the scale will allow of it. The boom, H, to extend the feet of the mainsail and foresail, is strengthened and supported by the diagonal braces, U U, &c. and farther secured and stayed by the fore and aftpieces, 32, 32, which are shewn more perfectly in the plan, fig. 30, and which may either be united by iron plates, bolts, and rivets, as before described, or be jointed together by knuckle joints and pins, as shown in fig. 31. The upper ends of the poles, Q Q, &c. are let into stop grooves, made around a wooden cap, 33, with a hole in its centre (as shown in the plan, fig. 32), to receive the top-gallant-mast, 34, which also passes through the tressel-trees, 35, affixed to the poles, Q Q, &c. To the foot of the top-gallant-mast are fixed the cross trees, 36, which are halved into each other at their crossing in the centre, and are secured to the heel of the topmast, which passes through a mortice hole cut in them, and they are fixed either by a fid or bolt. In striking the topmast the necessity of casting off the rigging is thus avoided, the shrouds being affixed to the cross trees, and these to the top-gallant-mast, and coming down with it, instead of the cross-trees being affixed to the top of the topmast, as usual. These cross-trees are placed at similar angles with the poles, Q Q, &c. as shown in fig. 32, and thus accommodate themselves thereto at any part of their descent, and are thereby kept steady when struck, which enables me to confine the topsail-yard, amidships, in keeping or furling the sail, and also when it is set. But as I cannot, in this manner, steady the yard in reefing or furling the sail, without striking the top-gallant-mast at the same time, so I have contrived another method, wherein the yard itself is affixed to cross-trees, as shown in fig. 33, and whereby it is kept steady within the poles. In this latter case the cross-trees of the top-gallant-mast may either be affixed at the head of the topmast as usual, or otherwise. As my open quadrangular pyramidal mast answers the double purpose of a mast and topmast, so I am obliged to introduce a substitute for the mast head or top in the common mast, and which is shown at 37, in fig. 24. This substitute consists of two cross pieces, extending to the four poles, Q Q, &c. supported below by the four angular braces, 38, 38, &c. and strengthened above by four others, 39, 39, &c. The cross pieces and braces are all secured to the masts by iron straps or plates, bolted and rivetted to them, and thus form a great addition to the strength of the mast. The lower yard, 40, is slung to the cross pieces. Between the openings around the cross pieces, 37, sets of bars are placed, which serve as a platform or substitute for a top. Fig. 34 is part of a brig, fitted up with courses, topsails, top-gallant-sails, and royals, set upon a wind. As the necessity of backing the sails around at right angles to the wind is avoided, I am enabled to shape the sails otherwise than is customary in square rigged vessels; for, as they always present the same leech to the wind in manufacturing them, I cut them so that all their goring may be in the fore leech, and the straight cloth in the after one. In fact, in this plan all the sails which in a square rigged vessel are usually termed "squaresails," are made on the principle of "lugsails," and I thereby make them to stand so much flatter than squaresails can possibly do, as to enable the vessel to lay nearer the wind. By reason of the sails revolving with the mast instead of around it, as usual, I cut away from the canvas in the foot of each topsail and top-gallant-sail, a notch or gap, in order to permit those sails to be brought nearly into contact with the sails below them, the gaps allowing the sails to clear the top and topmast head. I thus avoid the openings usually made between the sails, and the consequent loss of surface thereby occasioned. I myself prefer setting the royals on the principle of latteen sails, on account of their standing better upon a wind; but the shipowner may use his option herein. To the topsail yard-arms, fig. 33, I have affixed guys, 41, 41, &c. which I reeve through blocks fixed to the ends of the cross pieces, and lead them on to the lower platform, to the end that the sails may be "spilled" in reefing them, and the yards be as effectually secured by the use of lifts as in the usual way. A ship may be rigged precisely in the same manner as a brig, with the addition of a mizenmast. I have avoided showing the ropes necessary to be used in this mode of rigging, as they may readily be supplied by any persons conversant with nautical affairs. Fig. 35 exhibits the method of joining two poles together, to form a pole, Q, where timber of sufficient length cannot be had, namely, by means of the iron hoops or caps, 42, 42, &c. Fig. 36* shows a method of applying eight diagonal braces, U U, &c. and four fore and aft ones, 32, 32, &c. to extend the foot of the sail without a boom. Having thus described various methods of setting and working the sails of boats, ships, and other vessels, in my improved methods, I shall now proceed to explain my methods of reefing and furling them. Fig. 6, as before said, represents a latteen sail, with its yard, J, and boom, H H, attached to my open quadrangular oblique pyramidal mast, Q Q. 43 is a flat or oval tapering reefing-board, with pivots at each end of it, turning in holes made in the two upright stanchions, 44, 44, which are affixed upon the boom, H H. The sail is reefed or furled by turning the reefing-board, 43, by hand, and securing it by putting the pin, 45, into holes made in the stanchion and end of the reefing-board to receive it; the yard, J, at the same time turning upon the pin which connects it at 46 with the boom, H H. Fig. 36 represents part of a lugger with two of my open quadrangular pyramidal masts and lugsails. To this description of sails I use parallel reefing-boards, 43, 43, and either constructed and mounted as described in the above references to fig. 6, or in the following methods, when employed upon a larger scale. Fig. 37 is an elevation or front view of one end of a reefing-board, whose section is of an oval figure, as seen in the end views of it, figs. 38 and 39. This is framed together in the following manner:—In fig. 40, 47 represents the main or central plank viewed edgeways, in fig. 41 it is shown endways, and in fig. 42 in plan, or as looking down upon it. 48, 48, &c. are pairs of cross timbers, with a shoulder and tenant at one end of each, which tenants are passed through mortice holes, made at regular distances through the middle of the plank, 47, to receive them, and are secured by nailing them or rivetting them together, as is shown in fig. 41. The other ends of these cross-timbers are formed of an oval shape, as is also shown in fig. 41. This plank, 47, and these cross-pieces, serve to build the oval reefing-board upon. At each end of the cross-pieces dovetails are made, which receive into them the two rails, 49, 49; the spaces between the edges of the plank, 47, and these rails, are filled up with thin planks, clinched to each other, and nailed to the cross-pieces, 48, 48, &c. At each end of the reefing-board a block of wood is inserted, in order to receive the pivots on which it revolves, and which are secured in their holes by screws and nuts, as shown by the dotted lines in fig. 37. Circular holes, shown by other dotted lines, 50, 50, in fig. 37, may be made through these blocks in order to lighten them. Another construction of this oval reefing-board, adapted to a still larger scale, is shown in section, at fig. 43, being a number of ribs or bent pieces of timber let into gaps or notches, 51, 51, made in the edges of the plank, 47, at regular distances, as shown in fig. 44, and secured to the rails, 49, 49. The outsides of these bent timbers are then to be covered with thin planks, in the same manner as already described. To these reefing-boards I attach the sails at the foot, bottom, or lower edge of each sail, and reef or furl them by winding them upon the boards. In order to retain these reef-boards in an upright position, I can either employ a pin, in a similar manner to that shown at 45, in figs. 6 and 36, or the following contrivance. Fig. 37, as before said, is a front elevation of part of a reefing-board and the parts connected with it. Fig. 38 an end view thereof. 52 is a metal bar or lever, turning upon a joint affixed to the boom, H, and guided in an upright slit or groove made in the stanchion, 44. 53 is a metal spring, one end of which is affixed to the boom, H, whilst its other end applies itself underneath the lever, 52, so as to elevate it. 54, 54, are two similar pieces of metal, one of which is shown separately in fig. 45. To each of these pieces, 54, 54, a loose pall, 55, 55, &c. is hinged. 56, 56, are inclined planes, upon the opposite ends of the pieces, 54, 54, to which the palls, 55, 55, are hinged. These inclined planes do not project or extend so far from the edges of the reefing-board, 43, as the palls do. Fig. 39 shows one of the palls as in the act of depressing the lever, 52, during which depression the inclined plane, 56, can pass over the lever, 52, thereby allowing the sail to be unreefed or unfurled by the reefing-board, turning in the direction shown by the arrows, the opposite pall, 55, performing a similar operation in its turn, and so on, until the sail is sufficiently hoisted. On reversing the motion of the reefing-boards to reef or furl the sail, the inclined planes, 56, 56, pass of themselves over the lever, 52, depressing it by the action of the inclined planes, 56, 56, formed upon their backs; the lever springing up instantly on their passing over it preventing their return, as shown in fig. 46, by which means the reefing-board is held fast, and the sail may be hoisted tought up. On disengaging it the reefing-board must be turned in the same direction a quarter round, which drags the loose pall, 55, over the lever, 52, when on suffering it to turn in the contrary direction, by hoisting the sail, the loose palls again depress the lever, and suffer the fixed catches, 56, 56, to escape as above described. The lever, 52, may, if preferred, be elevated by means of a weight applied upon an arm or a prolonged part of the lever on the opposite side of its fulcrum. I work the reef-board, when made on a small scale, either by hand, or by a handle affixed to it when within reach; or, when partly out of reach, by means of a double lever, 57, shown in figs. 47, and two lines, 58, 58, suspended from it by thimbles, 59, 59, spliced to them, and acting upon pins or studs projecting from the side of the lever. When the reefing-boards are still more out of reach, as in the case of their application to brigs or other vessels with squaresails, I employ the following additional contrivance. In fig. 48, which is an end view of a reefing-board, of which fig. 49 is a bird's-eye view or projection on the same scale, and fig. 50 a side view of part thereof, instead of the straight double lever, 57, I employ a bent one, 60, to one end of which a line, 58, and thimble, 59, is affixed, the line reaching down to the vessel's deck. To the other end of the lever, 61, a weight, 62, is attached, sufficient to raise or elevate the opposite arm, 60. To the arm, 61, of the lever, a click or pall, 63, is hung, which catches into the teeth of a ratchet wheel, 64, affixed upon a square part of the axis of the reefing-board. The click or pall, 63, is prolonged on the opposite side of its pin or fulcrum, so as by the weight of that prolonged end to be kept ready to act in the teeth of the ratchet wheel. A similar apparatus is also affixed upon the other end of the yard and reefing-board. Upon pulling either of the lines, 58, the click, 63, carries round the ratchet wheel, 64, and the reefing-board with it; the catch, 56, and pall, 56, performing their offices as before described. The other line, 58, must then be pulled and let go alternately with the former one, and by a repetition of these movements the sail may be reefed or furled. To allow the sail to be hoisted, the reef-board must be managed, by means of the lines, exactly in the same manner as already described in the references to figs. 39 and 46. The reefing-board being in this case applied to the foot of the topsail, the stanchions, 44, 44, may be affixed to the loweryard, 65. The stanchions are also to be lengthened above at 66, in order to have lifts fastened to the eyes, the yard being slung under the top as usual, and furnished with a cross piece, 67, 67, as shown in fig. 51, by which, and the aid of the lifts, the stanchions are kept upright, as shown in section at 43, in fig. 52. As it is also desirable to be able to lower the yard and reef-board when necessary, I have contrived an opening, 68, fig. 51, in the middle of the top, but which I close at other times either by an iron link, 69, turning upon a pin in a joint formed on one side of the top, and united on the other side in a similar manner, or in any other secure way. In order to allow free motion to the reef-board between the diagonal braces, U U, see figs. 38 and 53, I extend them by a cross piece, 70, at each end, fitted to the ends of the boom, H, and upon which the stanchions, 44, are mounted. In fig. 36 is given an example of my improved method of equalizing the thickness and strength of those sails which are intended to be reefed or furled upon my reef-boards, and in which any considerable difference in their thickness would be prejudicial to their folding evenly. This I effect by stitching flat bands, made of any suitable material, either upon the seams or between them, at equal distances apart. I also do away with the bolt ropes at the fore and after leeches of the sails, and instead thereof apply the flat bands. The sail so equalised is shown at 71, 71. The topsail, in fig. 36, exhibits a method of setting a latteen topsail upon a lugyard, and which renders a topmast unnecessary. The topsail is hoisted by means of a halyard roved through a shieve in the masthead, and the lower end of the latteenyard is confined to the fore end of the lugyard by a tack rove through a shieve hole, and the sheet is hauled out in the usual manner. In fig. 36, at 72, 72, is likewise shown a method of setting a ringtail or studdingsail, 73, to the lugsail, so that it shall stand upon a wind, and act as one entire sail. This is effected by adding a studdingsail boom, 74, to the yard, J, and hoisting it by two halyards, 75, 75, the outer halyard being led through a shieve at the end of the studdingsail boom, 74, and then through a block at the masthead; and the inner one through a cheek block, and the end of the yard, J, and which may also be led through a block at the masthead. Fig. 54 shows the ringtail as not drawn quite up. I cut the ringtail so as to fit or coincide with the after leech of the sail to which it is to be joined, and to the yard and boom, so as to appear in every way as an enlarge-mast of the sail, 71. The sails are joined either by looping them together in the manner frequently applied in looping the legs of pantaloons, and as shown in fig. 55, in which figure 76, 76, &c. represent loops made of line, secured to the leech of the ringtail or studdingsail, at equal distances apart, and passed through other correspondent holes made in the leech of the sail, 71. This being done, the second loop must be passed through the one above or below it as you loop upwards or downwards, and so on through each succeeding loop to the last, which may be secured by a line passed through it, and belayed to any convenient place. On letting loose the latter line the whole will be loosened, and the sail can be taken in without delay. Another mode of attaining the same end is, by fixing a number of metal staples or shanks to metal plates, with holes in them, by which they may be stitched or otherwise secured to the leech of the ringtail or studdingsail, at equal distances asunder, as shown in fig. 56, at 77, 77, corresponding holes being, as in the former case, made in the leech of the other sail. The staples or shanks must be passed through these holes, and a line, 78, be passed through the whole of them, and be belayed to a cleat, as in the former case. On loosening and withdrawing this line, the sail can instantly be separated from the lugsail, and taken in. Fig. 57 is an edge view, and fig. 58 a side view, of one of the staples and plates, 77, 77, &c. shewn separately. I can also apply these methods of setting studdingsails and ringtails to all descriptions of vessels which require such sails, and whether fitted to my revolving masts or not. Fig. 59, in drawing No. 1, is a latteensail, fitted up with a yard, J, which is jointed at its fore end to the boom, H. Q Q, &c. in that figure, and in figs. 60 and 61, are two poles, as shown in fig. 61, joined at top to an angular block, made with stop grooves in it to receive them. The lower ends of the poles are jointed to the cross, P, upon the head of a revolving shaft, A, similar to that already described.

To the block at top is slung a toggle, 79, with two friction rollers within it, as shown in fig. 62, one on each side, which acts underneath two rebates, 80, 80, fig. 63, formed on each side of the yard, J, as shown in section at that figure. The sail is reefed or furled around the flat taper-reef-board, in the same manner as described in the references to fig. 6, of drawing No. 2; and whilst reefing, as the yard, J, descends, it brings the mast, Q, aft with it, and when completely furled, the mast lies close down upon it, it being lowered or reefed along with the yard. This plan has the effect of confining the top of the mast nearly at the same height above the yard in all positions, and also enabling it to lie exceedingly snug when lowered. In order to raise or elevate the yard, mast, and sail, I only employ a single tackle, 83. Although I have hitherto described my revolving shaft, A, as applied to various kinds of open masts, yet I can also apply it to the ordinary masts of boats, ships, and other vessels. Fig. 64 is an elevation of parts of a mast, 84, shrouds, 85, 85, &c. Dead-eyes, 86, 86, &c. and lanyards, 87, 87, &c. and fig. 65, is a cross section thereof. The foot of this mast is inserted within a hollow cast-iron cone, *n*, similar to that already described in the references to fig. 15, with a neck and pivot to it, turning in a collar and step. The pivot, however, does not pass all through as in fig. 15, but only reaches to a sufficient height in the mast to secure it firmly therein. Four or more arms, P P, are let into troughs or boxes, 88, 88, &c. open at their outward ends to receive the arms, P P, &c. and cast altogether with the cone, *n*. Four or more diagonal braces, 89, 89, abutting against the mast, and secured to it by iron knees and hoops, descend to the crosses, P P, &c. where they are let into them and secured by iron straps, &c. Between and underneath the arms of the crosses, two beams are strongly secured, to which the lower dead-eyes are affixed. In order to support these masts still more firmly, I can, as in the former case, employ circular sweeps and friction rollers. I have thus given examples of various methods of carrying my said improvements into effect. I do not, however, mean or intend hereby to claim as my invention any of the parts which may already be known or in use, neither do I mean or intend to limit myself to these methods only, but to avail myself of every mode in which my said revolving masts (which I believe to be entirely new) can be carried into effect. Although sails may have been reefed or furled at top, by being rolled around cylinders, yet I believe the idea of reefing or furling them below, upon flat or oval reefing-boards, is new, as well as the manner of working them; and I hereby claim all and every manner of carrying that part of my said invention into effect. The manner of striking the top-gallant-masts, by affixing cross-trees to the heels of them instead of to the head of the topmast, I also believe to be new, and equally applicable to the striking the top-gallant-masts of ordinary vessels, and the topmasts of small vessels, and I therefore claim every means of accomplishing that object. I likewise claim every mode of attaching and setting studdingsails or ringtails to the sails of vessels of every description requiring them, in the methods and for the purposes described.

In witness whereof, &c.

OBSERVATIONS BY THE PATENTEE.

From the experience I have already had as to the facility of the above mode of working the sails of vessels, having applied it with the greatest success to two boats of my own, I have no hesitation in offering it to public notice as far superior to any hitherto known or used, because here manual labour is reduced to its minimum, as regards the working of vessels. Fully satisfied with having accomplished this desirable object, I shall not take upon myself to determine how far ship-owners may derive advantage from it by reducing the complement of the crews of their vessels, as a certain proportion of strength is requisite for *other* purposes, independently of the working of the sails, viz. for weighing the anchor, loading and unloading the cargo, &c. With respect to weighing the anchor patents have been already obtained for gaining additional power; and if they were adopted in a revolving-masted-vessel, she could then certainly be sailed with the smallest possible number of hands.

I shall not, however, dwell on this point, because I conceive the other qualities of my plan are much more conspicuous; and these, I trust, will be fully considered by the owners of coasting vessels, before they determine on embarking their capital in the employment of steam.

Let them bear in mind that *wind* power, although it is not, like that of steam, under human control, *costs nothing!* Shall we then abandon it because it sometimes proves embarrassing or disadvantageous? Shall we not rather endeavour to discover an improved method of availing ourselves of it?

Now I consider a vessel rigged on my aforesaid plan, however weakly she may be manned, superior, as regards her "working to windward," to the *best manned* vessels of the common rig. For instance, in the former, whether applied to "fore-and-aft rigged" vessels, brigs, or otherwise, it is in the power of the helmsman *alone*, that is to say, without any assistance, to put the vessel about! Every seaman will appreciate this quality, in "turning to windward" in rivers or in narrow channels; and more especially in endeavouring to turn against a lee tide, when, in order to have a chance of succeeding, it is absolutely necessary to make very short tacks close in shore, out of the strength of the tide. Here the revolving-masted-vessel is under the *complete control* of the *helmsman*, who can tack her whenever his judgment points out to him the expediency of taking *immediate* advantage of any favourable flaws or shifts of wind; the nature, moreover, of the rig, enables the vessel to "shoot more in stays."

All these particulars considered, no doubt can remain but that the duration of a revolving-masted-vessel's voyage would be considerably shortened, to the great advantage of the ship-owner.

Another good quality arising from this plan would be, the very great reduction in the quantity of running rigging, and in the wear and tear of it; and also the optional disuse of the standing rigging.

These advantages, together with that of the vessel's holding a better wind, by reason of the sails standing *flatter*, would soon make ship-owners sensible of the benefit which they would derive from the adoption of this plan of rigging their vessels.

To those persons who reside near rivers, canals, or even the drains of the fens of Lincolnshire, I earnestly recommend this mode of rigging their boats, pledging myself that, by also adopting the principle of my plan of *ballasting* (for which I had the honour of being rewarded with a silver medal by the Society for the Encouragement of Arts, &c.) they will be enabled to work to windward without any other manual labour than that of managing the rudder, notwithstanding the limited space to work in.

Thus, a person may proceed in his boat a long distance, either for his amusement or for any useful purpose, against a strong wind, without the fatigue of rowing, punting, or tracking.

This plan is also well worth the attention of gentlemen who may be desirous of keeping their yachts or pleasure-boats at the smallest expence, both as relates to the number of hands composing their crews, and the wear and tear of standing and running rigging.

By adopting the revolving plan, together with my method of *reefing*, many serious accidents would be prevented on lakes, such as those in Cumberland, where sudden gusts of wind and squalls prevail. It would also be a most convenient rig for boats on smaller pieces of water, such as those attached to noblemen's and gentlemen's seats, as persons wholly unacquainted with the working of common rigged boats would soon learn to manage these. Even females or boys could navigate them with perfect safety!

The patentee is ready to grant licences for the revolving rig, or, for a fair remuneration, to superintend the fitting of any vessel, until the plan becomes more generally known.

Applications (if by letter, post-paid) to the Patentee, at Sir F. M. Ommaney's, MP. Norfolk-street, Strand, London, will be promptly attended to.

Specification of the Patent granted to Thomas Wolrich Stansfeld, *of Leeds, Yorkshire, Worsted Manufacturer;* Henry Briggs, *of Luddenderfoot, Halifax, in the said County, Worsted Manufacturer;* William Prichard, *of Leeds aforesaid, Engineer; and* William Barraclough, *of Burley, Leeds aforesaid, Worsted Manufacturer, for certain improvements in the construction of looms for weaving fabrics composed wholly or in part of woollen, worsted, cotton, linen, silk, or other materials, and in the machinery and implements for, and methods of, working the same.* Dated July 5, 1823.

WITH AN ENGRAVING.

TO all to whom these presents shall come, &c. &c. *Now know ye,* that in compliance with the said proviso, we the said Thomas Wolrich Stansfeld, Henry Briggs, William Prichard, and William Barraclough, do hereby declare that the nature of our said invention, and the manner in which the same is to be performed, are particularly described and ascertained in and by the drawings hereunto annexed, and by the following description thereof, (that is to say):—The first of our said improvements consists in an improved combination and arrangement of machinery or implements, for the purpose of communicating a revolving motion to the yarn beam or yarn roller of looms, to effect the giving out or unwinding of the yarn or warp therefrom, in proportion as it may be required for producing the cloth or fabric.

The second of our said improvements consists in the employment, in the working of such looms, of certain cylinders or rollers, for the purpose of unwinding and delivering the yarn or warp from the yarn beam or yarn roller of looms, in a regular and uniform manner, and in a continuous rotary movement communicated to it at intervals. The said cylinders or rollers we will denominate, for distinction, *delivering* cylinders.

The third of our said improvements consists in the employment of certain machinery or implements for the purpose of keeping the threads or yarns of the warp in a proper degree of tension when they are not separated or formed into a *shed;* and of relieving or slackening the warp, at proper intervals, sufficiently to admit of the separation being made to produce the shed without occasioning an unnecessary degree of strain upon the warp

Fig. 1, (Pl.VII.) upon the sheet of drawings which is hereunto annexed, represents an end elevation of the framing, and some of the principal parts of a loom such as is usually denominated a power loom. The supports for the centres of the wheelwork are supposed to be in a part removed, for the purpose of explaining our improvement more clearly.

Fig. 2 represents a longitudinal elevation of the same loom, supposed to be taken at the back thereof.

Fig. 3 represents part of the framing of a loom, with the chief parts of the machinery, supposed to be removed in order to explain the manner of applying our said delivering cylinder. Note, the figures are drawn to a scale of about 1¼ inch to the foot. A, figs. 1 and 2, represents the yarn beam or roller. It is supported upon pivots at its extremities, turning in two fixed brackets, 4, 4, as seen in fig. 2. One end of the yarn beam has a cog wheel, B, fixed upon it, which engages with the teeth of a pinion, *c*, the axis of which turns upon pivots in two small brackets, fixed to the cross rail, *b*, *b*, of the framing, as seen in fig. 2. This axis has a rachet wheel, *d*, fixed upon it by the side of the pinion, *c*. The rachet wheel, *d*, is adapted to be moved round slowly by the operation of one or more palls or clicks, *e*, which are fixed upon a centre, in the side of an arm or lever, *h i*. The end, *i*, of this lever moves upon a centre, in a fixed bracket, projecting from the cross rail, *b*, *b*; and the other end, *h*, has an oblong slit or groove formed in it, and is connected by a link or arm, *k*, with the small eccentric circle, *m*, which is firmly fixed upon the tappet shaft, *n*. Thus, every time that the said tappet shaft performs one revolution, it will, by means of the eccentric, *m*, and link, *k*, cause the lever, *h i*, to move once up and down, and by the clicks or palls, *e*, will turn the rachet wheel, *d*, and yarn beam, A, round, so as to give out or unwind a portion of yarn or warp therefrom. The degree or extent of movement which will require to be thus communicated to the yarn beam, (so as to give out the warp in a proper manner) will be constantly varying, by reason of the decreasing diameter of the said yarn beam, from the warp being wound from off its circumference. This variable movement is effected in the following manner: *o p* represents an arm or lever, which moves upon a fixed centre pin at *q*. The uppermost end, *o*, of this lever is made broad, as seen in fig. 2, and is adapted to bear continually in contact with the surface of the warp; upon the yarn beam being pressed or drawn sufficiently against it by the action of a small cord, *r r*, and weight, *t*, which is fastened to the said lever above the centre, *q*, the cord, *r r*, performs an entire turn round the pulley, *s*, upon the axis of the rachet wheel, *d*; then descends, and has the weight, *t*, attached to it. The lower end, *p*, of the lever, *o p*, is connected by a rod or link, *v*, with the centre pin of the arm, *k*, of the eccentric, *m*, before-mentioned. Thus, in proportion as the diameter of the yarn beam diminishes by the warp being wound off it, the upper end, *o*, of the lever, *op*, will approach the centre of the yarn beam, and the lower end, *p*, will consequently be moved outwards, and by its rod, *v*, will draw the pin of the arm, *k*, along in the groove before-mentioned, in the lever, *h i*, towards the centre, *i*, of the said lever, so that the motion of the eccentric, *m*, will cause the lever, *h i*, to move up and down through a greater space, which will, by means of the clicks or poles, *e*, move the racket wheel, *d*, round a greater number of teeth at each revolution of the eccentric, *m*; and, by the lengths of various levers, being properly adjusted and proportioned, according to the nature of the warp to be operated upon, or according to the diameter of the warp beam when full or empty, the warp may be caused to be given out equally, whether the yarn-beam be full of warp or nearly empty. The ordinary parts of the loom which are represented in the drawing will be sufficiently understood by persons conversant with such works, without our entering into a detailed description of them. We will therefore only mention them in a brief manner, as follows:—H represents the driving or fast and loose pulleys upon the end of the crank shaft, I, which has the fly wheel, K, fixed upon its opposite extremity: L shows the connecting rods proceeding from the cranks to the lay, M, which moves upon a centre at N, and is supposed to be furnished with the usual appendages of reed, shuttle, stopping apparatus, &c. P represents the heddles, which are caused to move up and down by the tappets, Q, seen in fig. 2. These tappets are fixed upon one end of the tappet shaft, *n*, which receives its motion by a cog wheel, *w*, and pinion of three to one, the said pinion being fixed upon one end of the crank shaft. R shows the pecking arm or lever for throwing the shuttle. It is moved backwards and forwards at the proper intervals by the strap, S S, and rods, *s s*, from the pecking tappets, T, which are fitted upon the end of the tappet shaft, *n*, so as to turn round freely, and independently of the said shaft. The pecking tappets, T, being moved round by a cog wheel, *x*, which is firmly fixed upon a boss or tube by the side of the said tappets, working into a pinion of one half its diameter, fixed upon the end of the crank shaft. V represents the roller, over which the warp passes in its passage from the yarn beam, A, to the heddles, and then over the breast beam, W, to the cloth roller or cloth beam, X, which is adapted to take up or wind the cloth or fabric upon its circumference as fast as it is produced. This may be effected in any of the ways which are at present known and practised for the purpose of taking up the cloth or fabric in looms.

We will explain, by reference to the fig. 3 upon the drawing, a convenient manner of applying our said delivering cylinder to a loom. A represents the yarn beam, which is mounted upon pivots at its extremities in the ordinary manner. B shows the delivering cylinder, which is made of wood, metal, or other suitable material. It is mounted upon pivots at its extremities, which are adapted to slide backwards and forwards in grooves or slits, in fixed brackets of the framing, as seen by the dotted lines in the fig. 3. The delivering cylinder is made of such length as to enter between the end plates or flanges of the yarn beam, and rest with its circumference in contact with the surface of the warp upon the yarn beam; and its surface is either made smooth and even, or it may sometimes be slightly ribbed or fluted in the direction of its length, in order to apply and hold better against the warp. The delivering cylinder shows a worm wheel, *c*, fixed upon one end of it, which engages with the threads of a worm or endless screw, D, upon the axis, *e* of which, is fixed another worm wheel, E, which engages with the threads of a worm or endless screw, F, fixed upon the tappet shaft, *n*. By this connection of wheelwork the rotary motion of the tappet shaft, *n*, communicates a slow and continuous rotary motion to the delivering cylinder, which, by its circumference being pressed in contact with the surface of the warp upon the yarn beam, causes a uniform and regular delivery of the warp to take place, which delivery will depend entirely upon the velocity with which the circumference of the delivering cylinder moves, whether the yarn beam be full of warp or nearly empty. The delivering cylinder is caused to move towards the centre of the yarn beam, in proportion as the warp upon the surface of the same diminishes in diameter, by means of curved levers, similar to what is seen at *a b*; which move upon a centre at *a*, in a fixed bracket of the framing. There are two of these curved levers, one at each end, which are adapted to bear against the pivots of the delivering cylinder. The lower extremities of the levers, *a b*, are formed to a hook, and have cords, *h*, fastened to them, which cords, after making an entire turn round the ends of the yarn beam, descend and have weights, *k*, attached to them. These weights always tend to press the circumference of the delivering cylinder into close contact with the surface of the warp upon the yarn beam: at the same time the cords, *h*, are adapted to create a sufficient degree of resistance to the motion of the yarn beam. The endless worm, D, is made sufficiently long to prevent the worm wheel, *c*, from getting out of gear when the delivering cylinder slides backwards and forwards to approach or recede from the yarn beam.

We will now describe a convenient manner of carrying our third improvement into effect, by reference to the figs. 1, 2, and 3 upon the annexed drawing. In the figs. 1 and 2 the position of the various parts is represented at the period when the yarns of the warp are relieved or slackened for the purpose of separating them to make the shed; and in fig. 3 the various parts are shown in a proper position, to keep the yarns of the warp in a requisite state of tension during the period that the yarns of the warp are not separated. It consists of two small rollers or rounded rods, marked 6 and 7. The one marked 6 lies beneath the warp, and is borne up against the underside of the warp by the aid of springs or weights, so as to be capable of yielding downwards in a slight degree. The other roller or rounded rod, marked 7, extends across immediately above the surface of the warp (as seen in fig. 2), and is attached by joints at its extremities to the uppermost ends of two links, marked 8. The lower ends of these links are attached to the short arms or levers, 9, which move on a centre or axis, 10, turning in fixed brackets of the framing. This axis has curved arms, 11, projecting from it on the opposite side, which curved arms are operated upon by small eccentric camms or tappets, 12, fixed upon the crank shaft, *i*, as represented in the figs. 1 and 3. Thus the revolving motion of the crank shaft and tappets, 12, causes the curved arms, 11, to move upwards, and by the connection above described the roller or rounded rod, 7, will be drawn downwards so as to bend the warp over the roller or rod, 6, and thereby keep the warp in a proper state of tension, when the shed is not required to be made, as represented by the fig. 3. But as soon as the crank shaft, *n*, has turned round, and arrived at the part where the shed is required to be made, the points of the tappets, 12, quit the curved arms, 11, and suffer the roller or rounded rod, 7, to be thrown upwards by its small spiral springs upon the links, 8, as seen in the figures; or, if desired, the roller or rod, 7, might be caused to rise up by the action of a weight applied to the extremity of the curved arms, 11, so that the said roller or rod would become clear above the surface of the warp, as seen in figs. 1 and 2, which will relieve or slacken the warp sufficiently to produce the shed without straining the warp in any material degree.

We have now described a convenient and advantageous manner of carrying our said invention into effect, by describing it, with reference to the annexed drawings, in such a manner as to enable persons conversant with works of a similar nature to put it in practice; and we do hereby declare that the only parts or combination of parts of the machinery or implements hereinbefore described, the arrangement and application of which we consider to be new as regards looms for weaving fabrics composed wholly or in part of woollen, worsted, cotton, linen, flax, silk, or other materials, are as follows :—

First, the improved combination and arrangement of machinery or implements as hereinbefore described, by reference to the fig. 1 upon the annexed drawing, for the purpose of giving out or unwinding the warp from off the circumference of the yarn beam. The parts to effect this improvement which we consider to be new, and which have not been before used for the giving out of the warp in looms are, the eccentric, *m*, the connecting link or arm, *k*, and the lever, *hi*.

Secondly, the employment of the delivering cylinder, marked B, in the fig. 3, which we consider to be new as regards its use in the delivering out of the warp in looms, and which has either a continuous rotary motion, or a rotary motion at intervals, communicated to it by means of a train of wheelwork, a rachet wheel, an eccentric, or other similar contrivance; the circumference of the said delivering cylinder being caused, by the operation of the curved arms, *a b*, cord, *h*, and weight, *k*, to bear continually in contact with the surface of the warp upon the yarn beam, so as thereby to turn the yarn beam round, and deliver or give out the yarn regularly. Thirdly, the employment of one or more rollers or rounded rods, as described by the numbers 6 and 7 in the figures upon the drawing, some of which rollers or rods are placed below, and others above the warp, and have motions communicated to them by eccentrics or other suitable mechanism, for the purpose of tightening and relieving the warp in the making of the shed, so as to prevent unnecessary strain upon the warp. The parts which we consider to be new in this improvement, as applied to the tightening and relieving of the warp in looms for the purpose aforesaid, are as follows :—The rollers or rounded rods, 6 and

7; the links, 8; the arm or lever, 9, 10, and 11, and the eccentric or tappet, 12.

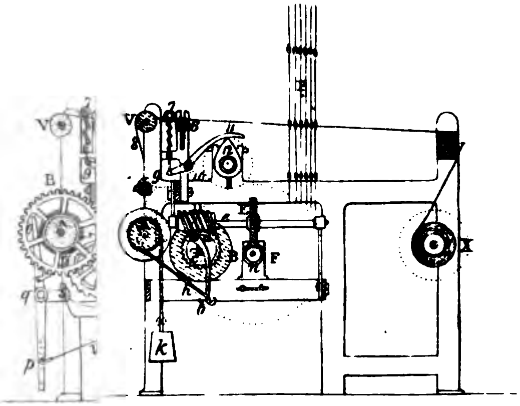
Observing that the form and proportions of the different parts of the machinery may be varied according to the discretion of the workman employed in manufacturing the same, or according to the nature of the fabric which the loom may be intended to weave. The materials of which the different parts of the said machinery may be made, may also be varied according to the circumstances of the case, without departing from the object of our invention, as hereinbefore described and set forth

In witness whereof, &c. &c.

Specification of the Patent granted to MATTHIAS ARCHIBALD ROBINSON, *of Red Lion-street, St. George the Martyr, London, Grocer, for certain improvements in the mode of preparing the vegetable matter commonly called pearl barley, and grits or groats made from the corn of barley and oats, by which material, when so prepared, a superior mucilaginous beverage may be produced in a few minutes.* Dated August 20, 1823.

TO all to whom these presents shall come, &c. &c. *Now know ye,* that in compliance with the said proviso, I, the said Matthias Archibald Robinson, do hereby declare that the nature of my said invention, and the manner in which the same is to be performed, are particularly described and ascertained in the following description thereof (that is to say):—My invention of certain improvements in the modes of preparing the vegetable matters, commonly called pearl barley, and grits or groats, consists of a peculiar mode of drying and otherwise treating the grain, by which process its vegetative properties are destroyed, and a meal is produced divested of rawness, and free from the impurities of husk or fibre; which meal, when so prepared, is soluble in water, and will make a fine mucilage in a few minutes. Any quantity of pearl

Fig. 3.



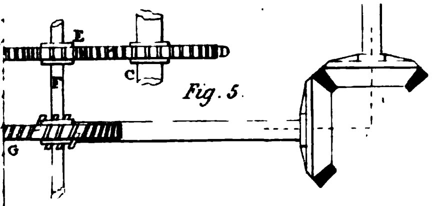


Fig. 5.

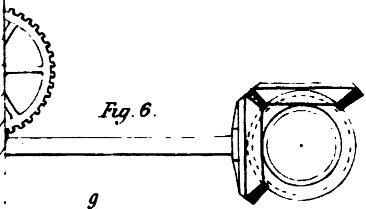


Fig. 6.

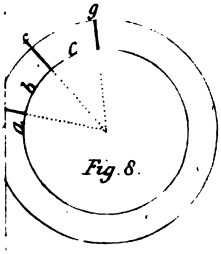


Fig. 8.

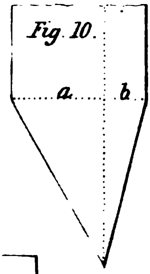


Fig. 10.

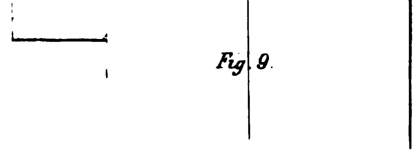


Fig. 9.

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barley or groats intended to be operated upon is taken in the state it is usually sold, and the first process in preparing is to cleanse it by winnowing from seeds, husks, dirt, dust, and other impurities. After this the grain is carefully looked over, and any extraneous matters which have not been separated by the winnowing are then picked out. In this cleansed state the grain is put into sieves, and spread over their bottoms in level layers, about three quarters of an inch thick. The sieves are then deposited on ledges, in closets heated by steam-boxes or steam-passages, the temperature of which should be gradually increased to 160° or 170° of Fahrenheit's thermometer. Under this temperature the grain must be suffered to remain drying gradually for about four hours, the aqueous parts evaporated being drawn off by suitable pipes leading from the hot closets. By these means the vegetative properties of the grain will be destroyed, and the raw taste removed, without parching or roasting it. When the grain has been thus sufficiently dried it is spread out in hoppers or troughs to cool, and when that is effected, it is to be passed through funnels to the hoppers down to steel mills. If ground by stone, they are liable to gritty substances; where it is ground by steam or any other efficient power, sliders must be introduced into the funnels for the purpose of regulating the supply. The meal falling from the steel mills is received into boxes or receivers, and is thence removed for dressing into bolting machinery of the ordinary construction. The cylinders of the bolting machines should be made of fine wire gauze, from twenty-four to forty-eight in the inch, and when the meal has passed through the finest of these, it may be considered to be completely fit for use. A table-spoonful of the prepared barley-meal may be mixed up in two spoonsfull of cold water, and when perfectly smooth, one quart of boiling water is to be poured upon it. This being suffered to boil for ten minutes, will produce the mucilage called barley water, which should be then strained through muslin, if required, flavoured with lemon peal or juice, and sweeten with honey, refined sugar, or sugar candy. An excellent food for infants may be made by mixing the above proportion with milk and water instead of water alone. It will also be found to be a very desirable material for thickening broths; it may be mixed and introduced into the broth half an hour before it is taken off the fire. Puddings of an excellent quality may also be made from the prepared barley meal; the powder of the prepared groats is to be mixed in the same way, and a gruel may be produced in ten minutes, of a quality very much superior to any other gruel made from any preparation of grits or oatmeal heretofore introduced to the public. I am aware that several variations may be made in the process above described; but I wish it to be understood that I rest my claim of patent right in a method or methods of drying the grain under a regular temperature, without roasting or parching it so as to destroy its vegetative properties, and at the same time retain its nutritive qualities unimpaired, and of clearing it from its fibrous and husky parts, after grinding, leaving only the pure and fine meal, by which preparation the meal is brought into a condition that will enable it to keep perfectly good in any climate.

In witness whereof, &c. &c. &c.

Patent granted to John Thompson, *of Vincent-square, Westminster, and the London Steel Works, Thames Bank, Chelsea; and* John Burr, *of Halesowen, near Birmingham, Engineer; for certain improvements in producing Steam, applicable to steam-engines, or other purposes.* Dated June 21st, 1825.

WITH AN ENGRAVING.

TO all to whom these patents shall come, &c. &c. *Now know ye*, that in compliance with the said proviso, we, the said John Thompson and John Burr, hereby declare, that our said invention consists of certain improvements in the mode of working and producing steam, applicable to steam-engines, and for other purposes to which steam may be applied; and which we effect by constructing a boiler or boilers, a generator or generators, of any convenient form and dimensions, and made of such materials as may be best adapted for the particular object or objects to which the steam generated may be required; and which boilers or generators, we cause either to revolve or reciprocate in a vertical, horizontal, or oblique direction; but we prefer to turn them horizontally in the fire.

The circular motion of our boilers or generators must be either continuous or reciprocating, but we prefer the former, and for these reasons, that the whole surface of our boilers or generators, will, in every part, be exposed uniformly to the action of the fire, besides rendering the machinery more simple and effective.

The whole of our boilers or generators must be enclosed in a convenient furnace, guarding only the axis or pivots from the powerful action of the fire, and placed in iron frames on the outside of the furnace, and in this situation they must be kept constantly in motion; by which, under a regular fire, the water contained in them will be heated to an uniform temperature, and the materials of which our boilers or generators are composed, will be subjected to an uniform heat, and thereby to an uniform expansion, which is not the case in stationary boilers. Our moving or revolving boilers or generators, must be supplied with water from one end of their respective axes or pivots, by a forcing pump, or other sufficient pressure, through pipes; which, by stuffing-boxes or other convenient means, the water can be conveyed into our boilers or generators, while they are moving, and yet prevent the escape of either water or steam.

Upon that end of the pipe which is in the interior of any of our boilers or generators, there must be attached a valve, which the expansive force of the steam will close, and which the power of the pump or other pressure must open, to admit the proper supply of water to enter any boiler or generator. At the opposite end of the axis of any of our boilers or generators, the steam must be allowed to pass either constantly or at intervals, as may be desired, by a valve opening outwards, which must have the means of being kept closed by any required force, according to the expansion of the steam to be used; or a cock or slide, or any other of the well-known means, may be introduced, by which an alternate or constant supply of steam may be kept up. If more than one boiler or generator is required, then it will be necessary that the steam so generated must enter into a gasometer or vessel, and from which the steam so generated must be drawn for the purpose of feeding any steam-engine, or for heating any vessel or place. It will be obvious that our boilers or generators may be employed, if properly constructed, either for generating low or high pressure steam; and they may be in the slightest manner, or more fully supplied with water, as the character of their employment may render necessary. If one boiler or generator is only used, and after the steam in it is brought up to its required state of expansion, then by means of a cock or valve, the steam may be allowed freely to pass into any cylinder or chamber, to which the steam is to be applied as a power for working machinery, or for the purpose of heating any substance or place.

The essential part of our invention consists, in making our boilers or generators move upon their pivots on which they are suspended in their fires, and while they are in motion, the materials of which they are composed are preserved; the heat or caloric economically applied, and the quantity of steam produced by the same portion of fuel will be found to be much greater than by any means yet employed for the generation of steam.

Figs. 4, 5, 6, and 7, (Pl. VII.) shew views of four of our generators or boilers, I I I I, with the necessary machinery turning them while they are in operation.

Fig. 4, represents an iron frame, with the pivots of four boilers or generators working in it. A A, one of the iron plates that come up against the brick-work of the furnace, and connected by iron pillars to the opposite iron plate which supports the other ends of the pivots of the boilers or generators. B B B B, are the four pillars that keep the iron plates together, without connecting them to the brick-work. C C C C, are the pivots of boilers or generators. D D D D, the four cog-wheels which work into the cog-wheel, E, and by the motion of which the four generators are turned. The cog-wheel, E, is connected to the axle or spindle, F, and at the opposite end of which spindle is fixed the screw-wheel, G, and which axle and wheel are turned by the endless pinion, H, and which pinion, with its shaft, may be put into rotation by any of the common means of producing circular motion. Care must be taken to afford sufficient play or lateral motion to the generators between the plates, A A, so that no expansion shall bind them in the pivot holes of the plates. The mode by valves, cocks, stuffing-boxes, and pipes, as before described, will render the means of supplying our generators with water, through the agency of a pump, to be worked as may be most convenient, and very obvious to any competent workman, as well as the means before described for conveying away the steam that may be generated in our boilers or generators. We do not confine ourselves to the particular modification of the furnace, generators, or the machinery for giving them motion; nor do we claim the abstract parts of which they are composed, nor the particular modifications which we have described; but as they are the means of applying the essential character of our invention and improvements, which is employing moving, instead of stationary boilers or generators, and any other mode by which circular or reciprocating motion is given to any boiler or generator; while it is enclosed either wholly or partly in any furnace or fire, for the purpose of heating water for the object of generating steam, we claim to be substantially our invention, and the adopting our improvements for generating of steam; and from the use of which the benefits before described will result.

In witness whereof, &c. &c.

Plan for making a Tunnel in the bed of the river Thames.

By Antarctic.

Abstracted from the Papers and Documents of the "Thames Archway Company."

With an Engraving.

Understanding from your advertisement that plans for making a tunnel *in the bed* of the river are equally entitled to your consideration as those for making one under it, I take the liberty of submitting some thoughts on that head I trust will be found useful.

It appears to be extremely desirable for this purpose, that a convenient portion of the bed of the river should be laid bare, in which case the operations immediately relative to the making of the tunnel may proceed, as if the works were carrying on upon the ordinary surface of the ground, at least as far as the part of the bed of the river laid bare would allow. The main object, therefore, in my view, is to keep out the water from a portion of the bed of the river while the work in it is proceeding.

To effect this, it occurs to me that a number of balks should be put close together in a circular form, and driven into the bed a short depth, forming a sort of tub without a bottom, which I shall in future call a dam. Supposing these so close together as to be water-tight (or so made by any of the means hereinafter pointed out, or by any other), and the water extracted from the interior, the thing would be done. It may, however, be remarked at this point, that though the circle is the curve of equilibrium in this case, it is, from the pressure being external, a tottering or unstable equilibrium, unless the dimension of the balks in direction of the radius be so large as to render any probable variation from truly circular of no consideration.

The balks that would be conveniently procured would not much differ from a foot square, and this, though possibly secure against any deviation from the truly circular figure, if the timber was very hard, would not, I am persuaded, by either the scientific or the practical man be thought sufficiently secure.

I therefore should recommend a number of circular ribs to be put within these balks, or (as they may be called) staves; and these ribs I would advise to be made of oak, their horizontal breadth being proportional to the diameter of the dam, and their thickness of convenient dimensions. They should, if they are exactly alike in strength, be placed closer together towards the bottom of the dam than the top, their distance from each other increasing as their position is higher. Braces and spurs may connect them together.

I have thus explained the principle on which this dam is to be rendered of sufficient strength to resist the pressure of the water; the propriety of adopting this or any other having considerable extent of base, presupposes that the bed of the river, when rendered dry to such extent, is not likely to be blown up by the water oozing through it; and such I imagine that of the Thames to be, which, I am informed, is undurated mud of considerable thickness. Where this tough bed becomes thin, and the substratum is quicksand, the disruption need not be apprehended, as I understand the quicksand can be drained by means of the driftway already made, which will prevent the blowing up of the bottom from that cause.

It is not in my power to go into the whole detail of the parts of this construction, nor is it at this period necessary; but I conceive that men of sound understanding and good practice in this species of engineering will, from what has been said, be able to form a satisfactory opinion whether the scheme be practicable, and to make an estimate of the expence of it, sufficient for your guidance as to the eligibility of its execution.

In the view of assisting such men in the formation of such opinion and estimate, I beg leave to add, that the whole pressure, at the time of high water, which the ribs will have to sustain, supposing the vertical height of the water 40 feet, and the diameter of the dam 80 feet, will be 900 tons; by which I mean, if these ribs were to be cut into parts, the centre of them by planes, as at *e f g*, fig. 8, (Pl. VII.) the passing through pressure of the part *a* against the part *b*, and of *b* against *c*, &c. &c. will be equal to 900 tons; of course whether the ribs are cut or not, the force remains the same. If six ribs should be thought adequate to this force, and so placed as to sustain each an equal part of it, then will the section of each have to sustain 150 tons; and supposing the depth of each rib to be 1 foot, and its breadth to be 3 feet 9 inches, the pressure on each square foot will be 40 tons; and I am of opinion that oak timber of these dimensions, well put together, would be quite equal to sustain this force.

1. Relating to the water-tightness of the dam; if the sides of the staves are planed tolerably smooth, and of equal breadth through their whole length (prismatic), and if they be placed close together, it appears likely, when the internal pressure is taken off, they will, together with ribs, be compressed into somewhat less diameter, and be brought still closer together and rendered tighter, perhaps sufficiently so.

2. They may be grooved and tongued.

3. If the outside edges of every adjoining two be made flush with each other, a thin board may be applied on the outside of each joint down a groove made for that purpose, which board, by the pressure of the water against it, would be likely to render the joint tight (see fig. 9).

4. If a strip of oil cloth were to be nailed to one side of each stave, and overlap about 3 inches beyond the

edge of the adjoining stave, it would probably keep out the water.

If any leak of consideration should be found to take place at the bottom where the staves enter the earth, clay may be thrown down outside, and rammed close to the staves; and, if necessary, thin piles may be driven round, at the distance of 18 inches or 2 feet, and as many high above the bed, to confine more effectually the clay when rammed, forming a species of coffer dam.

A very valuable property of this construction is, that it does not depend on the strength of the ground in which it is driven, but on the ribs to resist the pressure of the water; consequently, where these staves are driven over the tunnel, when a part of it is formed the ramming over it will not thereby be disturbed, and the lockage will be as well provided against in those places as in any other, and the dam or side of the tub, when removed, may be brought very near to the end of the tunnel. I presume that from 60 to 70 feet of the tunnel may be completed in each removal, in a dam of 80 feet diameter.

Another is, that as the staves are not driven far into the bed of the river, they will be very little, if at all, injured, and may easily be extracted and serve again and again for the same purpose; and so will the ribs.

I think the ribs and staves may be removed altogether from station to station after the staves have been extracted from the ground; and when removed, the latter driven down again as before. This operation will of course be done at the time of high water, when there is the greatest power of flotation, and the current nothing. Perhaps it may be built on the shore, and launched with its staves so attached as to be driven down the necessary quantity, when it is placed over its first station. May not the staves be held against the ribs by the means of a few hoops (perhaps only one), formed of ropes so contrived as to be slacked when the staves are to be let down, and to be again tightened when they are drawn up with the view of removal.

The ribs will require to be loaded to sink them at high water. The bottom ones are the most proper for this purpose; and for moving the dam a few barges may be attached to it when the water is rising, and within a few feet of its highest pitch.

The lowest rib will have to stand on stilts, adapted as to length to suit the bed of the river. The ends of the staves should be shod with strong sheet iron, and be uniform, but with their inside less inclined than the outside, by which the tendency from driving into the ground, will be to embrace the ribs. (See fig. 10, wherein *a* is greater than *b*.)

The force occasioned by the current of the water will be greatest, I presume, about mid-tide, when the depth of the water in the middle is about 30 feet; but as the centre of pressure will most likely be less than 20 feet from the bottom, the power to overset the dam will be effectually resisted, I doubt not, by the weight of its materials, and the hold which the staves have in the ground. If not, the dam may be moored up and down the river.

It may possibly be objected that this erection will materially impede the navigation. On this head I beg leave to remark, that as the section of the current will be somewhat diminished, the velocity of it will be somewhat increased, so that vessels going with the current will be carried past with somewhat more speed. It is, however, but fair, when the impediments which it may occasion are in view, to view also any advantage that may arise from it; and I conceive that as the current will be increased and directed more to the sides than now that the passage is open, they will be better washed, and therefore somewhat deepened, and consequently the wharfs so much improved.

I may further remark, that any impediment arising from the erection of this apparatus will be much less than would be unavoidable if a bridge were to be built there.

Further, that when the attempt at any undertaking is ultimately to render a permanent convenience to the public, a temporary and slight inconvenience may with propriety be tolerated. In regard to the tunnel itself, I should imagine if its upper side be placed one-fourth, or even one-fifth of its external diameter below the bed of the river, no damage can arise, either to itself or to the craft which may ever rest on it.

Where the bed of the river is hard, I should recommend that the bottom of the excavation be exactly fitting the external diameter of the tunnel, which I am of opinion would best be formed of bricks of the proper figure, well laid, with as little mortar or rather cement in the joints as can be managed.

Where any cavities in the bed are found, they should be filled well up with stiff clay; and if a large quantity of pebbles or bolders, of the size weighing from 4 to 14 lbs. were individually rammed into the body of the clay, so as to form about one-third of the mass, it would increase the density considerably, and be the fittest material, probably filling up the space immediately above the tunnel as high as the bed of the river. I might have added to the advantages before-mentioned which this dam would present, that of the free space, whereon might be laid the earth dug up, or rather as much of it as would be required to fill up the vacuities after the tunnel is built; as also of affording the opportunity of a horse-gin being introduced for raising the earth that must be entirely taken away, &c. &c. &c.

I have thus, Gentlemen, given you the leading features, very hastily drawn up, of what appears to me not unworthy of your consideration; and begging you to excuse any inaccuracy of expression which I fear may be found in many parts, I desire to subscribe myself, Gentlemen, your most obedient servant, ANTARCTIC.

MOTTO.—"*Let science guide.*"

The above project was formed and intended to have been presented to the Directors of this undertaking before their advertisement for plans appeared, which demands other conditions besides those herein conformed to, but which the author hereof cannot comply with, as his avocations and distance from town will prevent him alike from forming estimates, and from giving further specifications of this plan, which he presumes is matured enough in the leading features of it for the practical man, who is qualified for such kind of work, to put into execution.

On the Recovery of Land from the Sea. By MR. JAMES BLACKBURN, *Land Surveyor, Lothbury.* (Concluded from p. 42.)

Mr. Smeaton made an estimate and report for recovering a small portion of land on the banks of the Tamar, and also for the defence of the lands of the Earl of Kinnoul, on the rivers Ammon and Tay, North Britain; in both of which cases he recommended embankments as effectual and profitable remedies.

We know that failures have taken place, but they can uniformly be traced to the ignorance of the superintending party; in these cases, the principles on which the strength and durability of the embankments depend have not been considered, and the form and the materials of which they should be composed have been alike misunderstood: the former have been made of too perpendicular a form, hence being unable to withstand the weight of the sea, which, as is known, presses laterally as well as downward, and being longer exposed to the action of the tide in one place, it has either broken them down or undermined them; or the banks have been so injudiciously placed, that they have had to encounter difficulties which a skilful engineer would have easily avoided. In other cases indeed it may have been that these evils have been avoided, but others equally fatal have been overlooked; the embankments have either been made so low that extraordinary high tides have overflowed them, or they have been made so narrow that the water has burst them. To one of these causes may be attributed all the failures that have occurred, for where embankments have been skilfully made they have never been found to fail.

As it regards the expence and profits attached to these undertakings, there is no doubt that it is one of the most profitable modes of investment. The recovery of Lancaster Sands it was estimated would cost 200,000*l.* or 5*l.* 3*s.* 3¼*d.* per acre, at a time when the process was not so well understood as at present; on its recovery it was presumed it would be worth 40*l.* per acre, consequently the net gain would be 1,348,400*l.* though some men, capable too of giving an opinion on such a subject, asserted that it could be recovered at 4*l.* per acre. Mr. Young, in his Agricultural View of Lincolnshire, states, that the recovery of East and Wildmore Fens cost 400,000*l.* and after deducting that sum from their value, left a profit of 1,600,000*l.* A few instances promiscuously extracted from the Transactions of the Society of Arts and Sciences, will tend to illustrate this part of our statement.

The Rev. James Filewood received the gold medal for recovering fifty-six acres, at an expence of 649*l.* 4*s.* 1½*d.* or 11*l.* 11s. 10¼*d.* per acre. Mr. Knapping received the same for recovering two hundred and thirty four acres at 1100*l.* or 4*l.* 14*s.* per acre. Mr. Richard Moyle, for recovering a small quantity at 4*l.* 11*s.* 4¼*d.* per acre. Mr. Paynter, for recovering seventy acres at 344*l.* 2*s.* or 4*l.* 18*s.* 3¼*d.* per acre. Thomas Quayle, Esq. for recovering one hundred and ten acres at 850*l.* or 7*l.* 14*s.* 6*d.* per acre. Mr. Harriott, for recovering two hundred and sixteen acres at 570*l.* or 8*l.* 12*s.* 9½*d.* per acre; so that it appears the average cost is about 5*l.* per acre. There will, however, in addition to this expence, be the satisfaction of claims upon the soil, and other expences not included in the idea of recovering, although they are preparatory to, and a part of it. There will also be the loss of the interest of the money employed while the work is in hand, and the expence of keeping up the embankments after the land is in cultivation, allowing the average of which to be 3*l.* per acre, and valuing the land at 40*l.* per acre, there will be left the enormous profit of 400*l.* per cent. on the capital employed.

There is no doubt but thousands of acres may be recovered at a much less expence than this; there is, however, sufficient data to show that it has always proved most amply remunerative. In undertakings of this kind the profits consist not merely in possessing the land, but in the purposes to which the drainage may be appropriated, and in the tolls that may be made to arise from shortening the roads. Thus, for instance, in Morcambe Bay, Lancashire; the present road between Lancaster and Ulverstone is a very circuitous route of about 30 miles; if the lands were to be recovered, a direct road could be made from one place to the other of about 20 miles, for which, no doubt, the party recovering could procure an Act of Parliament (or a clause in an Act, which it would be necessary to obtain for the completion of this work) to authorise them to take toll on a road to be formed from one place to the other, which would be a source of immense revenue and profit. The drainage too could be turned to a most profitable account, inasmuch as in many cases it might be made to work machinery for grinding corn, sawing timber, or for the purposes of manufactories.

Having considered the quantity of land capable of recovery, the practicability of the undertaking, and the expence and profit attendant upon recoveries, its national importance should be considered; and here it may be viewed both as it regards local and general advantages. With respect to the former, in all cases of recoveries, nuisances are removed; for instead of the eye being presented with a sterile waste, which at least is cheerless and depressing, there might be seen tracts of land scattered with farms and villages, luxuriant in their production, lovely in their appearance, and the means of support to thousands; at once conveying pleasure to the passing traveller, and gratification to the philosophic mind. Such must be the feeling of every one on viewing the undertaking in Wales, before alluded to: to remember, that where the ocean once wasted its fury a town is now erected, yielding security and happiness to its inhabitants, must gratify even the casual observer.

It is not, however, merely that the eye is gratified by the transformation of sterile into cultivated land; Dugdale well knew this, when in his preface to his work on embanking and draining he says, "and if we weigh the great inconveniences which these overflowings have produced, certainly the advantage by the general draining ought the more to be prized; for in the winter time, when the ice is strong enough to hinder the passage of boats (as hath been by some well observed), and yet not able to bear a man, the inhabitants upon the hurds and the banks within the fens can have no help of food, nor comfort for body or soul; no means to baptize a child, or partake of the communion; nor supply of any necessity, saving what these poor desolate places do afford. And what expectation of health can there be to the bodies of men where there is no element good? the air being for the most part cloudy, gross, and full of rotten harrs; the water putrid and muddy, yea, full of loathsome vermin; the earth spongy and boggy, and the fire noisome by the stench of hassocks."

This was the case in the fens of Lincolnshire in the 17th century, and although they have been much improved since that period, it is a fair statement of what still exists in many parts of the country. The same author, in enumerating the advantages, adds, "and do we not see that when the grounds are secured and trenched, it is hard to find a poor man, though they sit at great rents? for their cattle being always sound and thriving, are therefore merchantable: moreover, beside the abundance of wool, hides, tallow, and other commodities which this fruitful ground produces, the channels for drainage do yield no small advantages for the carriage of their corn and merchandize, whereas before they were constrained to go many miles about."

The advantages attendant on the recovery or Morcambe Bay are described by Mr. Beatson: he says, "the execution of this project would be attended with the most beneficial results to a very extensive tract of that great manufacturing county (Lancashire), and be ultimately felt, in some measure, by the nation at large. There would not merely be an addition of territory, larger than either of the islands of Guernsey or Jersey, but it would tend to improve at least four times that extent of the interior country; a safe and speedy communication would be opened between the towns of Lancaster, Whitehaven, Ravenglass, &c. and all the intermediate country, instead of a very circuitous route, or a precarious, dangerous, and often fatal passage over Lancaster Sands. Independent of the advantages arising from the produce of the land to be acquired, the produce of the interior part of the country, which is extremely fertile and well cultivated, would be easily brought to market; whereas it is at present with the utmost difficulty and inconvenience that any commodity whatever can be transported over those dangerous sands." Not only in Morcambe Bay would these advantages be realized, for there are numerous bays and inlets on our coast, of a smaller size, where similar results would follow their recovery; for it generally happens, that towns on the borders of, and rivers running into bays, are similarly situated as that to which the reader has been referred.

Where land is recovered on the banks of rivers, another advantage derived is, that by confining the water the courses are deepened: thus many rivers, which at present are not navigable, might be made so, to the evident benefit of the country through which they flow.

So important and practicable has this object appeared to that enlightened body of men, the Society of Arts, that for many years past premiums have been offered by them, to those who could furnish testimonials of having accomplished any undertaking of this kind.

At a time when our population, and particularly our agricultural population, is increasing to an enormous extent; when our poor houses are filled, and our parishes burdened with active peasants, and when others are emigrating to foreign countries, surely it is no indifferent matter that a plan should be found, whereby four millions of acres of land can be afforded for their employment. Allowing one man to cultivate ten acres, here is at once permanent employment for 400,000 labourers (and consequent support for their families), or one forty-eighth part of the population of the whole empire. But if we consider it with a view to national subsistence, it will furnish support, on the average number of inhabitants and acres in the United Kingdom, to one million three hundred and sixty-three thousand souls.

It was with a view to national subsistence that Dugdale in his preface applauds the recovery of lands from the sea, and having stated what advantages have attended inclosures of commons, he adds, "If then the mere inclosure of that which naturally yielded little profit doth justly deserve commendation, how much more is the skill and pains of those to be had in esteem who have recovered vast proportions of land totally overwhelmed by water?"

Many may say, but there are Commons, inclose them; and so says every well-wisher to the prosperity of the country, if they can be advantageously redeemed; but it must be remembered that the commons are often of the most sterile and unproductive nature, very frequently having but an inch or two of soil to cover the barren staple beneath: but although we do not wish to say aught against that which has been unanimously acknowledged to be of great importance, it should be remembered, that the land to which we have referred is much richer, and more productive than any common in the country, and infinitely more capable of rewarding its industrious tillage.

We extract from a very spirited piece, on Waste Lands in Scotland,* the following paragraph, in which we entirely coincide:—"In enquiring how far the national interest is involved in the neglect of waste land, it is scarcely necessary to state the superior advantages resulting from the pursuits of agriculture compared with those of any other art. It may suffice here to say, that every wise Government will consider the prosperity of agriculture as the first and most important of public concerns—as the surest foundation of national prosperity, and entitled, above all other subjects, to the peculiar attention of a virtuous and enlightened administration. The staple and permanent strength of every nation depends chiefly on the facility with which families can be reared and maintained. If food, clothing, and habitation are readily obtained, the increase of the human race will follow as a matter of course: but should the number of inhabitants exceed the means of subsistence, they must either emigrate or perish for want. The strength and stability of the State therefore depend, first, on the number of its inhabitants; and next, on the facility with which the people in general can rear, support, and educate their offspring, according to their respective stations."

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* Communications to the Board of Agriculture, Cap. xi.

Description of a Stop-cock for transferring Corrosive Gases.

By Mr. T. Griffiths, Church-street, Kensington.

From the Transactions of the Society of Arts, &c. Vol. xxii.

The Silver Vulcan Medal was presented by the Society to Mr. Griffiths for this communication.

WITH AN ENGRAVING.

The common brass stop-cocks, if they have been employed for confining acid or other gases, especially when under pressure, are soon corroded throughout their whole interior extent, so that the plug or key becomes immoveable, and the bore filled up with a salt of copper, the consequent result of chemical action upon the metal of the instrument. A stop-cock made entirely of glass has also many disadvantages: its size and clumsiness of form, together with the difficulty of uniting it securely to other apparatus, are inconveniences often felt by the experimentalist.

To obviate them, and to offer a method in which stop-cocks of the common form are united with security against the attacks of active chemical agents, is the object of this present communication.

In accurate experiments on the absorption of gases by solid or other bodies, the advantage of having an apparatus not liable to be acted upon by the substances under examination will be readily acknowledged.

Platina is the material best adapted for this purpose, if its high price did not in most cases prohibit its use; most, or, perhaps, all its advantages may however be obtained in the method about to be described, and at a comparatively moderate expense.

The invention consists in making a stop-cock of the usual form, but of rather smaller dimensions, and selecting a piece of platina wire of sufficient thickness to allow a hole being drilled through its axis; this operation forms a thin tube of platina, which is afterwards accurately fitted into the bore of the brass stop-cock, leaving about one-sixteenth of an inch projecting at each end, which is to be opened and extended so as to cover each extremity with a plate of platina. The brass plug or key has a platina tube secured as above described, with the addition of two small discs of platina, placed at right angles to the gas-way or bore; these, together with the platina tube and brass parts of the instrument, are ground down perfectly air-tight.

It will be obvious from this explanation, and upon reference to the engraving, that whether the stop-cock be open or closed, platina is opposed to the action of the gas or other agent. In the one case it protects the gas-way and ends of the instrument, in the other the small disc of platina prevents corrosion of the plug.

If it were desired to confer security to a moderate extent upon a stop-cock as usually employed, this may be easily effected by taking a glass tube, cutting it to the required length, cementing one portion into the plug, and the other into each end of the bore: if this be carefully done, so as to avoid any fragments of glass falling into the ground parts, it will be found very effectual in preventing corrosion, the gas-way always remaining clear.

While collecting gases in a mercurial gasometer a large body of gas has to pass through the aperture of a stop-cock, which at the same time it rapidly corrodes. If a stop-cock lined with glass be employed in this experiment, it will be found to possess many advantages over that in common use, with little additional trouble or expense.

To prove how accurately a glass tube may be fitted into the brass with cement, several instruments constructed in the above manner have had the tubes filled up with nitric acid without any solution of metal taking place.

It should, however, be remarked, that the protection of the instrument is withdrawn when closed, but this is of no great consequence in common experiments. If it is an object to have it protected in an equal degree when open or shut, the disc of platina formerly described may be resorted to.

Reference to the engraving of Mr. T. Griffiths's improved Stop-cock for chemical purposes.

Plate VII. fig. 11, is a longitudinal section of a stopcock, represented as open.

The cock, A A, is made in the usual manner, but with an additional platina tube, *a a*, passing through it, and over its ends, *bb*: the plug, B, has also a similar piece of platina tube, *c*, passed through and fixed within it: there is also a disc of platina, *d*, fig. 12, fixed on two opposite sides of the plug, B, at right angles to the tube, *c*, which resists the action of the gas (when shut) that may be contained in any vessel to which it is attached.

Fig. 12 is an external view of the plug, B, (in the same position as in fig. 11) showing one of the discs, *d*, of platina.

Fig. 13 is a view of the opposite side of the plug, showing the end of the platina tube, *c*.

Account of the Cera de Palma, gathered in the Andes of Quindiu.

BY M. J. BTE. BOUSSINGAULT.

Annales de Chimie, vol. xxix. p. 331, July, 1825.

The palm tree, which MM. Humboldt and Boupland have made known, under the name of *Ceroxylon Andicola*, produces, somewhat plentifully, a combustible substance, called in that country *Cera de Palma*. In order to obtain it the trunk of the palm is scraped, and the scrapings are boiled in water. The *Cera de Palma* rises to the surface of the liquor, from whence it is gathered, and then left to dry. That which is got from the Indians who prepare it, is in the form of small cakes, of a yellowish white. It is porous, very friable, and softens by the heat of the hand;

It resembles, in its appearance, certain calcareous tufas; it has no taste, and very little odour.

The *Cera de Palma*, reduced to a fine powder, and put to digest in alcohol, makes it of a pale yellow. In operating at the ordinary temperature, it dissolves very little of it; the undissolved part is perfectly white.

The alcoholic tincture, evaporated, left a yellowish residue, slightly bitter, and having the appearance of rosin.

The *Cera de Palma*, deprived of its colouring matter, was treated with hot alcohol, in which it dissolved very readily. Five or six parts of boiling alcohol, marking 94° of the alcoometer of M. Gay Lussac, dissolved one part of the *cera*. On cooling, the solution formed a mass, and then resembled congealed olive oil. Supposing that this mass might be a mixture of wax and rosin, it was diluted with a large excess of alcohol, and filtered. The alcohol became milky by the addition of water; being evaporated, it deposited a white substance, having the same properties as that which remained on the filter, and which may be considered as the essential part of the *Cera de Palma*. Being dried, it was white, granulated, rough to the touch, and without taste or odour. The alcohol, when hot, dissolved a large proportion; in the cold it was scarcely soluble.

It dissolved in sulphuric ether; by evaporation the ether deposited it in the state of a crystalline powder.

It is soluble by heat in caustic potash; the solution is somewhat soapy.

Nitric acid, at the common temperature, has little action on it; by the aid of heat it converts it into a yellow substance and oxalic acid.

It melts at a temperature a little above that of boiling water (when the barometer is 0·560^{m}), assuming a brown colour. At a stronger heat it inflames, and burns with smoke.

Sulphuric acid turns it yellow and dissolves it; water precipitates it from this solution in the form of a white powder. It seems, after these trials, that the substance analyzed is a species of rosin, and that it is improperly named *palm wax*. At least the *Cera de Palma*, as it comes from the *Ceroxylon Andicola*, does not appear to contain wax; but in order to render it fit for making candles, either animal fat or vegetable wax is added to it.

Dated at the Laboratory of the School of Mines at Bogota, (in the republic of Columbia), August, 1825.

Method of using pure Muriate and Sulphate of Soda in the manufacture of Glass. By M. Leguay.

From Annales de l'Industrie Nationale.

Muriate of soda, or marine salt, is of very little value, compared with carbonate of soda or carbonate of potash, generally employed in the composition of glass. A casting is readily obtained of very fine glass, having, when about three or four lines in thickness, a very slight green tinge. Its composition is as follows: Decrepitated muriate of soda, 100 parts.—Slaked lime, 100.—Sand, 140.—Clippings of glass of the same quality, from 50 parts to 200.

Sulphate of soda likewise offers a great economy in its employment. Its results are very satisfactory. The glasses made with this salt were of very fine quality. The following is the composition: Dry sulphate of soda, 100 parts.—Slaked lime, 12.—Powdered charcoal, 19.—Sand, 225.—Broken glass, from 50 to 200.

These proportions give a fine coloured glass, which may be employed with advantage in glass-houses where a fine quality is sought after.

The following is a second way of operating with sulphate of soda; the proportions may be as follows: Dry sulphate of soda, 100 parts.—Slaked lime, 266.—Sand, 500.—Broken glass from 50 to 200.

According to this process it is obviously easy to operate in a regular manner, and to avoid expensive trials in the manufacture.

ACCOUNT OF NEW PATENTS.

Patent granted to JOHN HAM, *of West Coker, Somersetshire, Vinegar Maker, for an improved process for making vinegar.* **Dated October 7, 1824.**

IN this process an apparatus for aerating the liquor and keeping it at a due temperature is used, which consists of a large deep cask, or other vessel of a similar form, divided by a hurdle or perforated partition, supported by rafters horizontally in its middle. Through this partition, and through the cover, a pump passes from the bottom, where it is so supported on a pivot or point, as to be easily made to turn round. From its upper part, just beneath the cover, two or more spouts project from it at right angles, which extend to near the sides of the vessel, and are perforated with numerous small holes at their under parts.

The upper division of this vessel, above the partition, is filled with small twigs, of the size used for brooms, up to the level of the spouts, and the lower division is filled with the vinegar liquor, to within five or six inches of the partition. Through the upper part of this liquor "a *pewter* pipe" circulates, by which steam is passed, to bring the liquor to the required temperature, which the patentee states to be from 80° to 100° Fahrenheit; but the latter in preference. Into the part of the vessel between the liquor and the partition, a pipe passes from without for the passage of air, which may be made to circulate either by being drawn out or forced in by the action of a pair of bellows applied to the pipe, or to the upper part of the cask, between its cover and the twigs; which cover, in the latter case, must be air-tight, and in the former sufficiently open to admit the air to pass in a quantity which, in both cases, is but as little as possible to exceed that, which the vinegar liquor requires, to supply the oxygen that it absorbs; and it may be known when the air in the vessel has been exhausted of its oxygen, by trying whether a lamp or candle will burn in it or be extinguished.

The apparatus being prepared as described, the pump is to be worked either by hand or by machinery, and to be turned round at the same time, to make the liquor that runs from its spouts fall evenly on all parts of the twigs; the air being drawn slowly through the twigs at the same time in the manner mentioned.

By this apparatus and process the patentee states that the vinegar will be completed in from 15 to 20 days.

The general principle of this apparatus seems good; but the revolving of the pump would, we apprehend, be found very troublesome in practice, particularly if worked by hand; and the use of a pewter pipe, for passing the steam heat through the vinegar, is particularly objectionable, from the strong action which vinegar has on that metal. In the large vinegar works in the neighbourhood of London, the species of pipe used is composed of tin, with a very small alloy of copper. The substances also which it would be sure to extract from the twigs would be very likely to injure its flavour and other qualities.

If this process will demand so much as from 15 to 20 days to complete the vinegar, as stated, it would be difficult to conceive in what respect it excels the very simple and cheap method directed by Boerhaave a century ago for the same purpose, and which requires but from 12 to 15 days, according to Vauquelin.

Patent granted to ALEXANDER GALLOWAY, *of West-street, City of London, Engineer, for a machine, or machines, for the forming and moulding of bricks, and other bodies usually made from clay, plastic, or other materials, from which building and fire-bricks are commonly made.* Dated 14th May, 1825.

IN Mr. Galloway's machine for moulding bricks, tiles, &c. a circular horizontal table, having various apertures through it, (some of which hold the brick moulds, and others serve as passages for the brick-clay, to a pressing apparatus beneath it), is made to turn round, by having teeth round its circumference, in which those belonging to another horizontal wheel of equal diameter work, but which has teeth only in two opposite portions of its edge, each comprising a sixth part of its periphery; this revolving table is placed close above a floor, or platform, in which are two apertures, through one of which the clay is forced upwards into the moulds in the revolving table, and through the other the crude bricks are discharged from the moulds, as will be explained, on a moveable receptacle, that brings them out from under the platform, and from which they are carried off to be dried, but whose construction is not particularly described by the patentee.

The number of brick moulds to be placed in one of the cavities of the revolving table is not limited, nor the number of cavities to be applied to this purpose in the said table; but to facilitate the description, we will suppose at first that the table has but one cavity for holding moulds, and another for conveying the clay to the presser, and that the number of moulds in the cavity is nine; a cylinder being then placed directly under one of the apertures in the fixed floor, with a piston working in it from below upwards, and a portion of clay, properly tempered, being put by a hopper into the aperture designed for it in the revolving table, on the table turning round this clay is brought over the cylinder, and falls through the fixed floor into it; the table then moves on, till the other aperture holding the moulds comes directly over the cylinder, at which time the first sextant of teeth on the periphery of the wheel, which turns that of the table, having passed beyond it, the table will stop; and at that moment an excentric wheel, or crank, moved by the general machinery, raises the piston, and forces up by it the clay from the cylinder into the moulds; the other sextant of teeth of the impelling wheel, having by this come round to the revolving table, again turns it, brings forward first another hopper of clay and lets it drop into the cylinder, and then advances the next aperture holding brick moulds; after which the revolving table stops again, for the cause already explained, and the same operations just mentioned are again repeated, and continue to be so successively, as long as the impelling wheel is turned. A vertical shaft passes through the centre of the revolving table, and moves round with it; and a pointed screw at top and another at bottom, which pass from the frame work of the machine into the opposite extremities of this shaft, afford means of adjusting the distance of the revolving table from the fixed floor, to any degree required; and a scraper placed across this floor cuts off the superfluous clay from the bottom of the moulds, as the revolving table carries them over it, and thus completes the crude bricks ready for delivery through the other aperture of the floor, which delivery is effected by a set of small pistons, that work up and down in the moulds, whose rods ascend through a frame above them that it is carried by the revolving wheel; each piston rod is furnished with a separate helical spring, that surrounds it and raises the piston upwards to the top of the moulds; and all the rods of one compartment of moulds being fastened to a piece of wood level at its under face next them, and formed at top into an inclined plane or wedge; and another piece of a similar shape being fixed to the general frame-work of the machine, exactly over the second aperture in the floor, in a reversed position above the first inclined plane, in the track through which this is brought round by the revolving wheel, when the moving inclined plane is pressed in its progress against that which is fixed, it is forced to descend, and drives before it all the pistons of the moulds; and their contents, or the crude bricks are thereby pressed out from them downwards, through the aforesaid aperture in the floor into the receptable placed beneath for their conveyance from the machine, the moulds being at the same time prepared for the reception of a fresh quantity of the tempered clay. To prevent this clay from sticking to them, and to other parts of the apparatus, the patentee only directs, that the portion of it that is put into each hopper, should be previously covered on all sides with as much sand as will adhere to its surface.

The general machinery for turning round the parts described, consists of a vertical shaft descending from the centre of the wheel, that turns the revolving table at intervals by its opposite sextants of teeth, near the lower part of which a horizontal mitered wheel, of about half the diameter of the upper wheel is fixed; and beneath it a vertical mitered wheel of half its diameter turns on a horizontal shaft, at the further end of which is a drum wheel, from which a leather strap passes to a similar drum on the primary shaft that is turned by the force of horses, or steam, or other first cause of motion; and on the same horizontal shaft is fixed the excentric wheel or crank, that gives motion to the large piston that forces the clay upwards from the cylinder into the moulds, this horizontal shaft passing for this purpose directly beneath the cylinder, and of course bearing the excentric, or crank, exactly under the centre of its piston.

The method described here for giving motion to one revolving table for moulding bricks, may be used for as many similar tables as can be set round the large horizontal wheel bearing the toothed sextants, by multiplying the wheels, cylinders, pistons, and other parts connected with them, in proportion; and two of them are represented in the drawings arranged in this manner, but the patentee does not confine himself to any limited number of them; and it may easily be conceived how a still greater number of these revolving tables might be worked by one primary mover, if required, by suitable machinery in common use.

The machinery described in this specification seems imperfect in some material points. In the first place it has no contrivance for pressing the clay from the hoppers through the revolving table into the cylinder; and from the adhesive nature of the clay, it is not at all probable that it would fall of itself into the latter with any regularity. Secondly, no means are described for conveying away the crude bricks from the machinery after they are protruded from the moulds; and thirdly, the sanding directed of the external part of the whole mass of clay, intended to be put at once into one of the hoppers, would in our opinion be quite inadequate for preventing the clay from adhering to the moulds, and to the other parts of the apparatus with which it would come into contact.

It having occurred to us that a material part of Mr. Galloway's apparatus was similar to the invention for which Mr. Thomas Gilbert obtained a patent, in August, 1811, we think the following account of that gentleman's patent may be acceptable to our readers.

Mr. Gilbert's specification describes his apparatus for making bricks and other similar articles, as being constructed in this manner. A horizontal circular table is prepared, about the thickness of a brick, close to the edges of which three rectangular cavities are made, at equal distances asunder, each extending about 16 inches in the line of the radius, and about 18 inches in the other direction, which cavities are to hold the moulds for the bricks. Beneath this table is fastened a circular disk, toothed all round its circumference, and a pivot or axle passes through the centres of both table and disk, into a frame below, which keeps their motion even and steady. Close above the table, between its centre and ledge, a frame is placed across, which supports a "clay cylinder" constructed in the usual manner, the bottom of whose vertical axis turns below in this latter frame, and its top in the horizontal beam of a larger frame, which encloses the whole apparatus. At the top of the axis of the clay cylinder a toothed wheel is fixed, of about half the diameter of that beneath the table, and these two wheels are made to revolve and remain at rest alternately by two larger horizontal wheels, placed opposite to them on another vertical axis, which turns in the same frame-work as the first. These last wheels have teeth only on a third part of their circumferences, which effects the intermission of motion of the table and of the clay cylinder, just mentioned, without requiring a cessation of their own motion; the communication from the primary impeller of the machinery is made to the axes of these wheels in any approved common method.

The brick moulds are put into and removed from the cavities of the revolving table by hand, and the intermission of its motion is to admit of time for that operation, while the stoppage of the revolution of the clay cylinder at the same moment is to prevent the clay from being pressed down injuriously against the top of the table.

The mould for forming the bricks is a sort of box, with its bottom and one of its sides turning on hinges, and separated into divisions for three bricks; its bottom is perforated to let the water pass that is pressed out of the clay, and short pegs arise from it that support pallet boards in each division, on which the crude bricks are supported. Two of these moulding boxes are placed together in each cavity of the table, and being sanded in the usual manner previously, when afterwards taken out deliver the crude bricks with facility, on the one side being turned down, and the partitions along with the opposite side, to which they are fastened, being then turned over from the bottom. The pegs also expedite the removal of the bricks by admitting the fingers of the brickmaker to pass beneath the pallets, on which they are to be transferred to the wheelbarrow for conveyance to the drying-grounds.

Clauses of variation, and multiplication of parts, as is usual in such cases, conclude the specification.

In comparing the latter apparatus with that of Mr. Galloway's, the similarity of their revolving horizontal tables for holding the moulds, and of their partially toothed wheels for causing the intermitting motion of these tables, must be obvious; but Mr. Galloway's engine differs from Mr. Gilbert's by the addition of the compressing cylinder and piston, by the moulds being fixed in the table, by the contrivance for forcing the crude bricks out of them by the machinery, and by not having what Mr. Gilbert calls the common "clay cylinder," by which he evidently means the common pug mill, with inclined horizontal arms for forcing down the clay, this effect of it being mentioned in more than one part of his description.

Mr. Gilbert's specification, though very concise, contains very sufficient directions, and his engine, with the small addition of a cutter or scraper to the frame, in a proper position for separating the clay smoothly from the top of the moulds, would, we think, completely effect the purpose for which it is intended; which, it appears to us, would not be the case with Mr. Galloway's more complicated apparatus, as described in his specification, from the deficiencies, before observed, of matters necessary for its perfect performance.

We take the opportunity of the present subject to correct a small error in our notice of the patent of Mr. Leahy, for the same purpose, in our sixth number (vol. i. p. 419, line 11), where, instead of the words "Mr. Hudson," Mr. Sandford should be inserted.

Patent granted to JOSEPH FREDERICK LEDSAM, *Merchant, and* BENJAMIN COOK, *Brass-founder, both of Birmingham, for improvements in the production and purification of coal gas.* **Dated May 31, 1824.**

THE methods directed by the patentees to accomplish the objects of their patent are, first, to mix the coal from which the gas is to be distilled with common salt, or with the saline substances taken from the bottom of salt pans, previous to putting it into the retort.

Secondly, to pass the gas produced through layers of dry salt.

Thirdly, to pass the said gas through a solution of salt.

Fourthly, to pass the gas through a solution of silver, copper, iron, zinc, or other metal, in nitric or other acid.

Fifthly, to use any two or more of the said processes in combination.

The patentees state, lastly, that they do not direct any particular sort of vessel or apparatus to be used for effecting the above purposes; and that they only claim the passing coal gas through salt and its solution, and through metallic solutions, to be secured by their patent.

We conceive that the effect of putting marine salt with coal into the retort, will be only to promote the vitrification of the earthy portion of the coals, and produce a quantity of slag, similar to the clinkers drawn from the grates of large furnaces. The saline matter from the bottoms of salt pans often containing sulphuric salts, may at the same time, by the action of some of them on the muriatic salts in the heated retorts, produce some muriatic acid, which will unite with any ammonia which may be in the coal, and neutralize it, but will also do great injury to the retorts.

Passing the gas through either dry marine salt, or through its solution, cannot, we apprehend, produce any effect whatsoever, for even if the coal held substances which would produce sulphuric acid in the retort, which alone could have any effect on the salt, the sulphuric acid would be converted by the carbonaceous matter into sulphurous acid, which would have no effect on the marine salt; and even the supposition of the presence of such substances in the coal is an extreme case, not at all likely to occur.

The effect of passing the coal gas through metallic solutions, would be to remove from it sulphuretted hydrogen, but would also cause a loss of its actual substance, as carbonated hydrogen, of which it consists, would at the same time combine with the oxygen of the metallic oxides, united to the acids in these solutions. The enumeration of the various metals in the specification, the solutions of which might be used, could hardly be necessary, when that only of iron in sulphuric acid, or common copperas, could approach a cost by many degrees low enough for the purpose, and even that this copperas would be sufficiently cheap for this use is extremely doubtful. At all events, the mention of the solution of silver might have been omitted, we apprehend, without any prejudice to the value of the patent.

Patent granted to MOSES POOLE, *of the Patent Office, Lincoln's Inn, London, for the preparation of certain substances for making candles, including a wick peculiarly constructed for that purpose.* Communicated to him by a foreigner. Dated June 9, 1825.

IN the specification of this patent, tallow is directed to be *separated* into two "*acids,*" one of which is fluid, like oil, and the other of a solid consistence, and two methods are recited for producing this extraordinary chemical phenómenon.

In the first method the tallow is to be brought to the state of soap by any of the alkalies, or by lime, and then to be decomposed by an acid; the product which floats at top of the fluid is then to be well washed, and this product, which consists of the tallow in the state of the two *acids* first-mentioned, is to be submitted to a press for "*oil seeds,*" the action of which will press out the fluid "*acid*" from the solid; the former of which is to be used as oil, and the latter for making candles.

In the second method for the same purpose, the tallow is directed to be distilled, and the product which passes over is to be washed, and submitted to the oil press as before, to separate the fluid *acid* of the tallow from the solid *acid*; and the patentee states that this second process may also be used after the first, for the more perfect separation of the two *acids* of which the tallow consists.

The wick of a peculiar construction, mentioned in the title, is to be formed of cotton yarn twisted somewhat harder than is usual for that purpose, and is to be wound round a thick wire, in the manner in which the large strings of some musical instruments are covered with very fine wire; and the wire with the cotton thus wound on it, is next to be put into a mould for making candles, and the tallow, or other proper material, in a state of fusion, is then to be poured into the mould, and when the whole is sufficiently cold afterwards, the wire is to be withdrawn, leaving the wick behind in the candle.

We have seldom seen in so small a compass more gross errors, or such entire ignorance of the first principles of chemistry, in any document professing to treat of chemical subjects, as are exhibited in the specification of this patent. As a curious developement of the aberrations of the human intellect, we should be glad to know what could lead the patentee to assert, that tallow consisted of two acids, or that the matters of which it was composed, or into which it can be converted by saponification, were *acids*.

Foutcroy, and other eminent chemists, have long since favoured the public with accounts of the chemical nature of tallow and oils, and from these, the last thing that we should imagine is, that they were composed of *acids*; and it is even the opinion of the excellent chemist first mentioned, that the sebacic acid which is procured from tallow by certain processes, is entirely a result from these processes, proceeding principally from the action of the fire used in them, and by no means existing previously in the tallow.

In our Numbers for December, 1815, and for January, Feb. and March, 1816 (vol. xxviii. and xxix.) may be seen a very interesting memoir on the nature of fatty substances by M. H. Braconnot (translated from the *Annales de Chimie*), in which the first process claimed by the patentee, is described, in the section of the *Action of the Alkalies on Fat;* consisting of the saponification of the fat, decomposition by an acid into adipocerous matter and oil (but not into *two acids* as the patentee mis-calls them), washing, and separation of the oil from the adipocerous matter by pressure. We cannot therefore conceive on what any person can found a just right to the monopoly of a process, which has been thus known so publicly in this country for nearly ten years, and which has doubtlessly been repeated in every chemical laboratory here, where matters of this nature were objects of consequence.

As to the second process of the patentee, we are surprised how any person of the least judgment could be led to suppose, that any benefit could result from it for the purpose mentioned; it would indeed be, on the contrary, wasteful in the extreme; for a great part of the tallow would by it be converted into ammonia, sebacic acid, and fœtid empyreumatic oil, which latter is scarcely of any use from its intolerable odour, and would communicate its stench to the little tallow that would be left, instead of the latter being in any way improved by the process.

Indeed even the first process, although it would produce adipocerous matter, of which candles might be made, would probably, after deducting the expence of the alkali for saponification, of the acid for the decomposition, of the labour, and of the various other charges attending it, and of the loss of weight, turn out to be a method of making adipocere as little advantageous as that attempted by Dr. Gibbs some years ago near Bath, of making a substance of this kind from dead horses, to which he gave the name of Gibbesium.

This first process would also have the disadvantage of subjecting the business to the Excise, and all its troublesome regulations for the soap manufacture.

The patentee in the title of this patent denominates himself "of the Patent Office, Lincoln's Inn," which might lead many persons to suppose it to be an office appointed by Government for the procuration of patents; this is not the case, the name being entirely an assumption of the patentee and his predecessors, with the view of attracting such business; and is in fact merely the office of the attorney and solicitor-generals, the patentee being the clerk to their clerk, Mr. Dealtry. Of Mr. Poole's judgment, knowledge, abilities, and qualifications, for transacting such important matters, the specification of this patent exhibits a specimen!

Patent granted to JOHN CHAS. CHRIST. RADDATZ, *of Salisbury-square, Fleet-street, London, Merchant, for certain improvements on, or connected with, steam-engines. Communicated to him by* ERNST ALBAN *of Rostock, in the Grand Duchy of Mechlenburgh Schwerin, Doctor in Medicine.* Dated 14th May, 1825.

THE "improvements" of Dr. Alban communicated to the patentee, relate to the construction of boilers for steam-engines, or rather to substitutes for them, or to steam-generators, and to a regulator for the fire to be applied to them; which latter, and the application of metallic balnea to the steam generators, constitute the chief claims of the patentee to patent right.

The steam generator consists of several small vertical tubes of copper, or wrought iron, closed at bottom, and descending at equal distances from a larger horizontal tube into which they are screwed; and within this larger tube a small tube passes above the tops of the vertical tubes, having small apertures in it, directly over them, through which water is conveyed by a forcing pump, for the production of the steam. This generator is inclosed in another vessel of iron, beneath which the fire place is constructed, and which contains a mixture of fusible metal, consisting of two parts of lead, and one part tin, that when heated by the fire beneath it, communicates a high temperature rapidly to the vertical tubes, into which the water being then injected by the small tube mentioned, will be instantly converted into steam, which passing upwards into the large horizontal tube, is from thence to be conveyed to the steam-engine, by any common convenient arrangement of pipes and valves.

The large horizontal tube is divided lengthways, and fastened together by flanches, with screws and nuts, for the convenience of getting at the smaller tubes more readily; and is besides furnished with a loaded safety valve, by which the pressure of the steam may be regulated.

The rod of the forcing pump that supplies the generator with water is raised by the machinery of the steam engine, but is pressed down again by a weight only; by which simple contrivance the water must cease to enter into the generator, when the pressure of the steam exceeds a certain force.

The regulator for the fire, which prevents the bath of metal from being over-heated, consists of an air valve that is raised from, or lowered down on, the top of a vertical tube (through which alone the air passes into the ash pit for the supply of the fire), by the variation of the expansion of air confined in a pipe, one end of which is immersed in the bath of metal, while the other enters into a close vessel containing quicksilver, from the bottom of which a tube ascends that contains quicksilver also, in which a float of iron is suspended from one end of a horizontal balance, the other end of which sustains the valve, before-mentioned, over the mouth of the air tube.

We have described the apparatus of the patentee in its most simple form; but it is evident that its several parts may be multiplied as required for the increase of the production of steam, and that two or more sets of vertical tubes, enclosed in as many metallic baths, may be also used, being combined together by suitable pipes; and a combination of two sets in this manner is, in fact, represented in the drawings of the specification, in which the vessels that hold the metallic baths are not broader than what is barely sufficient to enable them to contain the vertical tubes, and consequently have very narrow bottoms.

The only particularity of the fire place for the steam generator that is mentioned in the specification, is a partition that ascends from its back about a third of the depth of the vessel that holds the metallic bath, which causes the heat of the fire to pass nearer to its upper part than it otherwise would, and from whence the flue descends again to a level with the top of the fire place before it passes off to the chimney. In the drawing the fire place itself is in the form of a dome, with an opening at top of about a third of its diameter, beneath the vessel that holds the metallic bath and the steam generator.

The use of metallic baths has been long since proposed by Dr. Lewis in his well-known work on the arts, but we believe has not been yet used for steam generators, though we know it has been noted by a friend of ours in his memorandum book, as a useful addition to Mr. Perkins's steam generator, when that contrivance was first made public; and we think it will have a very good effect in preserving the vertical tubes from injury by the fire, and in thus allowing them to be made thinner than what would otherwise be expedient.

The apparatus is certainly ingenious, but the use of tubes for steam generators is by no means new, nor is their arrangement in it such as might be expected from a gentleman, whose abilities and knowledge have been so highly and publicly extolled as Dr. Ernst Alban.

Count Rumford proved, many years since, how very small a portion of heat could be communicated side-ways to any boiler, or other apparatus, from a fire; and yet this seems so entirely unknown to the learned Doctor, that his generator is disposed, as if the lateral communication of heat was, on the contrary, the most advantageous, and that from below upwards of little comparative importance, as the sides of his metallic baths are so extensive, and their bottoms so extremely narrow, that in fact a method could be hardly contrived in which a less portion of the heat could be made to act directly on these vessels, and consequently in which so large a part of the fuel would be wasted to no purpose.

The vertical disposition of the steam generating tubes cause them to have the same defect, if possible, still more than the vessels mentioned; but we have still stronger grounds of objection to them. The learned Doctor ought to have known, when he authorised iron vertical tubes to be used for his generators, and set the example of doing so in the generator which he has had constructed, that at the heat which he professes to use with them, the water on entering them would be decomposed, its oxygen combining with the iron, and thus more or less rapidly corroding the tubes, while its hydrogen passed off with the steam, risking explosions in a manner that we have before frequently explained on similar occasions.

Besides this corrosion of these vertical tubes, another danger awaits them, which would probably be more rapid in its effects; no common water that we know of, is exempt from making earthy deposits in vessels in which it is boiled, and iron seems particularly to aid these depositions by its attraction to them; we may thence easily imagine how soon these small tubes of the apparatus would become clogged with encrustations,and how difficult and troublesome it would be to clean them afterwards.

We leave our readers to judge, after this, how far these generators deserve the eulogiums published of them in a cotemporary work, " that they cannot be destroyed," and that " when once proved, one of them will last for ever," which, they very shrewdly add, " is an object that has never before been attained in any apparatus for generating steam." We can assure our readers this was not meant in jest, but as serious and solemn assertion, and is but a small part of what has been put forth in the publication to which we allude.

FRENCH PATENTS.

Brevet d'Invention, for fifteen years, granted to M. Etienne Dreé, *for certain processes, which have principally for their object the employment of copper in making colours, or in the preparation of several well-known products of art, such as sulphate of copper, soda, &c.* Dated September 25, 1807. (Concluded from p. 69.)

Processes by which new colours for painting are produced, or the fabrication of those already known ameliorated.

THE METHOD OF MAKING ALL COLOURS FOR PAINTING, FABRICATED AT PRESENT BY PRECIPITATION WITH POTASH OR OTHER FIXED ALKALI, IN A MUCH MORE ADVANTAGEOUS MANNER.

Instead of the fixed alkalies employed commonly in precipitating colours, such as lakes, the English greens, &c. make use of pure ammonia, prepared as is recited farther on, in the article *ammonia;* you will thus obtain all the colours, as by the ancient method, with this advantage, that the supernatant liquor, instead of being useless, as happens when potash is employed, gives products at least as important as the colours precipitated.

FABRICATION OF SULPHATE OF COPPER BY SULPHATE OF AMMONIA AND SOLID COPPER.

Take a large quantity of sulphate of ammonia and of solid copper; separate from it all the ammonia, in the manner shown in the article, *Sulphated Green*. You will thus change this product into sulphated oxide of copper. Dissolve this latter in diluted sulphuric acid (for example, such as is found in the manufactories of this article before it is made more costly by concentration); you will then obtain, by evaporation and crystallization, a sulphate of copper much more pure than that of commerce, whilst all the ammonia returns into the circle of operations.

It is to be noted, that the sulphate of ammonia employed in making the sulphated copper and ammonia, is only a residue, of which all the expence has been defrayed by the products of the operations by which it has been produced; that this sulphate of ammonia may be made every where at a cheap rate by the decomposition of gypsum, or of the sulphate of iron contained in the washings of pyrited turf; that all the ammonia employed in making this sulphate of ammonia returns naturally into the composition of the same product; that the sulphuric acid required in this process is limited to the quantity necessary for bringing the sulphate of copper from the minimum to the maximum of the acid, and that by this means we may employ, usefully, the immense quantities of this acid which nature yields so abundantly in the sulphates of lime and of iron.

THE FABRICATION OF SULPHATE OF COPPER BY THE MURIATED OXIDE OF COPPER.

Prepare the muriated oxide of copper in a quantity sufficiently large to serve for the fabrication of the colours, and for that of the sulphate of copper; dissolve it in sulphuric acid, diluted with water; evaporate, crystallize, and slightly water the crystals with cold water, divided into small drops, and you will have sulphate of copper of great purity.

By adding the washings of the crystals to the liquor in which they have been formed, and in treating it with copper, fresh muriated oxide of copper may be obtained.

The sulphuric acid diluted with water only takes from the muriated oxide of copper the excess of its base: so that it passes from the state of muriated oxide of copper at a minimum, to the state of muriated oxide of copper at a maximum; and as this muriate crystallizes with difficulty, it remains in the liquor which lies over the crystals of the sulphate of copper, and becomes again muriated oxide.

An advantage which arises from this method is, that the muriatic acid necessary to form the muriated oxide of copper, in returning again continually into the circle of operations, becomes an instrument which is perpetually employed without ever being impaired.

AN ADVANTAGEOUS PROCESS FOR SEPARATING GOLD AND SILVER FROM COPPER, EITHER WHEN IN ALLOYS, OR UNITED WITH IT BY PLATING.

By treating the clippings or other waste of copper, which has been plated with gold or silver, with muriatic acid, or with a liquor composed of muriate of soda and sulphuric acid diluted with water, or with any other mixture capable of producing an action between the copper and muriatic acid; by accelerating this action; by preventing, at the same time, the muriated oxide of copper from mixing with the gold and silver that is separated, by simply decanting the liquor when it is in the state of brown muriate of copper well saturated, and when the formation of the muriated oxide is approaching; by treating the undissolved metal with a new quantity of the dissolving liquor, and in the same manner, to complete the solution of the copper, without forming the muriated oxide; finally, by fusing the metals which remain unattached with substances capable of depriving them of the small quantity of muriatic acid or muriate which may adhere to them, the gold and silver may be obtained the same as they were, and without any loss.

The decanted liquors treated with copper form the muriated oxide of copper, the numerous uses of which have been explained.

The application of this method may be extended to the inferior alloys; the only difficulty is to give to the metal the extent of surface which the nature of the action between the muriatic acid and the copper requires.

A PROCESS FOR OBTAINING SODA MORE ADVANTAGEOUSLY, BY THE DECOMPOSITION OF MURIATE OF SODA.

It may be seen, by the processes which have been described, that to obtain muriatic acid, it must be extracted from the muriate of soda, and that sulphate of soda is then produced, which may be collected in very large quantities.

The quantity may also be increased, if desired, by directly decomposing the muriate of soda by sulphate of ammonia, which is abundantly obtained in various operations; and by this means the manufacture of soda may be combined with that of muriate of ammonia.

The sulphate of soda, once formed, may be decomposed by charcoal and iron; or the sulphate of soda may be in the first instance converted into sulphuret of soda by charcoal; the formation and the preservation of the sulphuret will be facilitated by adding a proportional quantity of sulphur to the mixture; this sulphuret will be decomposed by dissolving it in cupreate of ammonia; the liquor is to be decanted from the precipitated copper; finally, the ammonia is to be separated from the soda by an economical distillation, and soda and sulphuret of copper will be obtained, which may be applied to use by converting it, by suitable means, into sulphate of copper, or using it for other purposes.

As large quantities of muriate of lime are obtained in many processes as an occasional product, this muriate may be employed usefully in decomposing the sulphate of barites; the muriate of barites thus produced may be then decomposed by carbonate of ammonia, and carbonate of barites and muriate of ammonia will be procured as the result; with the former of these products (carbonate of barites) soda may be advantageously procured from the sulphate of soda.

Description of processes, by means of which certain substances may be obtained, which serve as primary materials in several of the processes described in this memoir.

AMMONIA.

To obtain ammonia an apparatus is to be used, constructed on the principle used in heating wooden boilers, in which the furnace is so managed that it serves for the distillation of dry animal substances, while the wooden vessel contains liquids (as for example, urine); these operations may be accelerated by causing the chimney of the furnace to pass through a vat filled with the same liquor, which, in acquiring by this means a tolerably large degree of heat, becomes by so much more disposed to distillation; a great quantity of ammonia may be thus obtained at a small expence, in performing two operations by the same fire, and by a single process with only one apparatus, and at the same time.

In the ammoniacal charcoal coming from the distillation of the dry animal matters, a material will be found fit for the manufacture of prussian blue; and the residue from the distillation of the urine will afford those phosphates which are sought for by those who prepare colours for porcelain.

This process has the advantage of substituting for potash, which is a dear article, ammonia, which is obtained at a small expense from refuse and filthy matters, the using up which contributes to general wholesomeness.

CUPREATE OF AMMONIA.

To obtain cupreate of ammonia, pour merely the ammoniacal liquor, obtained by the preceding process, on the mixture of oxide of iron and of green muriated oxide of copper. This latter will be dissolved readily and completely; the cupreate of ammonia will be formed, and the small quantity of muriate of ammonia which it contains will cause to return into the circle of operations all the muriatic acid of the muriated oxide.

By treating in the same manner a mixture of alumen and muriate oxide of copper, the cupreate of ammonia is also obtained, and the pure alumen will remain for the uses to which it may be applied.

By treating, in the same manner, all the different quantities of copper, undissolved and remaining from the different operations, all the oxide which is not carried away by the washings, or which is formed afterwards, and is attached to the copper, will be quickly dissolved, and the cupreate of ammonia be formed.

By this simple operation the complete separation of the oxide from the copper is effected, which repeated washings and the most careful labour could not perform, and the copper is thus rendered fit for every other operation.

ARSENATE OF AMMONIA.

To make the arsenate of ammonia, dissolve in the ammoniacal liquor the white oxide of arsenic in powder to saturation; by making the mixture boil for some minutes in a distilling apparatus, to avoid the loss of the arsenical vapours; mix this arsenate of ammonia, supercharged with the acid of arsenic, with as much of the ammoniacal liquor as it will require, and you will obtain by this simple method an arsenate of ammonia, with the proportion of base necessary for the shade which is desired to be given to the green arsenate.

OXIDE OF COPPER.

To make the oxide of copper, take soluble sulphate of copper, which you are to reduce to a fine powder by depriving it of its water of crystallization at a mild heat; dissolve this powder directly in the cupreate of ammonia, you will thus obtain two quantities of the oxide of copper for one; that is to say, the base of the sulphate, and that of the cupreate; you will save the pounding of the sulphate of copper, and you will find in the liquor a sulphate of ammonia separated from the precipitate, and free from the quantity of water which the aqueous solution of the sulphuret of copper had introduced into it, and which would have been an impediment in using this sulphuret of ammonia for the formation of triple compositions.

By the same process, the mixture of the sulphate of copper and the sulphate of ammonia will be applied to use; for in dissolving sulphate of copper in this mixture, and adding to it afterwards cupreate of ammonia, the residues will be brought back again to the state of oxide of copper and of sulphate of ammonia.

Brevet for ten years granted to MM. PAYEN, *Harness Makers, of Vaugirard, and to* MM. PLUVINET, *Manufacturers of Sal-ammoniac, of Chicky-la-Garenne, for the preservation and making wholesome, of matters proceeding from the quartering of beasts.* Dated June 26, 1812.

THE processes of the brevettees consist in converting the blood, flesh, intestines, and other soft parts of animals, into a dry, solid, and inodorous matter.

These substances are boiled in a caldron, with a portion of water sufficient to prevent their sticking to the bottom or sides; the blood loses its fluidity, and becomes converted into a compact matter, which is the more solid the longer the boiling is continued; the flesh and the intestines also become changed into more firm substances, since these are only meats dressed, and almost dried, by the action of the great heat of the water.

As in this state these matters have still sufficient humidity to endanger their corruption, their drying must be completed. In the summer they may be dried in the sun; but in the winter recourse may be had to the artificial warmth of a stove, slightly heated, if thought proper; but the matters should be previously wrapped up in canvas, or enclosed between sieves of iron wire, and submitted to the action of a strong press, after their being boiled, in order to force as much water from them as possible.

After this labour, the bones, entirely deprived of flesh, should be exposed in a covered place till perfectly dry, where they may be broken, without any danger of causing bad scents.

REPEAL OF LETTERS PATENT.

THE KING v. LISTER. THE KING v. HADDEN.

In the Court of King's Bench, (Jan. 19, 1826,) two cross writs of *scire facias* were prosecuted, the first by Mr. Hadden against Mr. Lister, the second by Mr. Lister against Mr. Hadden, to repeal patents respectively obtained by those gentlemen, for machines applying heat to the preparing, roving, and spinning wool. Mr. Hadden, in the first cause, succeeded in showing that the specification of his own patent included the principle of Lister's, which was subsequent, and consequently a verdict passed for the Crown. In the second case Mr. Lister went further back, and proved that the principle of Mr. Hadden's patent had been acted on long before, and thus also obtained a verdict for the Crown. Thus each party succeeded in overturning the other's patent, and both are repealed.

⁂ The specification of Mr. Hadden's patent was inserted in our 37th volume, and the specification of Mr. Lister's will appear in our next number. We understand that Mr. Lister had granted licenses under his patent to the amount of three thousand pounds per annum.

LIST OF NEW PATENTS.

John M'Curdy, of Cecil-street, Strand, London, Esq. for improvements in generating steam.—Dated Dec. 27, 1825.—(*Six months to enrol specification.*)

James Ogston and James Thomas Bell, of Davies-street, Berkeley-square, London, watchmakers, for improvements in the construction or manufacture of watches of different descriptions. Communicated by a foreigner. Dated January 6, 1826.—(*Two months.*)

Richard Evans, of Bread-street and Queen-street, Cheapside, coffee-merchant, for improvements in the apparatus for and process of distillation.—Dated January 7, 1826.—(*Six months.*)

Henry Houldsworth, the younger, of Manchester, cotton spinner, for improvements in machinery for giving the taking-up or winding-on motion to spools or bobbins and tubes, or other instruments, on which the roving or thread is roving, spinning and twisting machines.—Dated January 16, 1826.—(*Six months.*)

Benjamin Newmarch, of Cheltenham, Esq. for an improved method of exploding fire-arms.—Dated January 16, 1826.—(*Six months.*)

John Rothwell, of Manchester, tape manufacturer, for improved heald or harness for weaving purposes.—Dated January 16, 1826.—(*Two months.*)

Henry Anthony Koymans, of Warnford Court, Throgmorton-street, London, merchant, for improvements in the construction and use of apparatus and works for inland navigation. Communicated by a foreigner.—Dated January 16, 1826.—(*Six months.*)

John Frederick Smith, of Dunston Hall, Chesterfield, Esq. for an improvement in the process of drawing, roving, spinning, and doubling wool, cotton, and other fibrous substances.—Dated Jan. 19, 1826.—(*Six months.*)

William Whitfield, of Birmingham, for improvements in making or manufacturing of handles for saucepans, kettles, and other culinary vessels, and also tea-kettle handle straps and other articles.—Dated January 19, 1826.—(*Six months.*)

Benjamin Cook, of Birmingham, brass founder, for improvements in making or constructing hinges of various descriptions.—Dated January 19, 1826.—(*Six months.*)

Abraham Robert Leorent, of Gottenburgh, merchant, at present residing in King-street, Cheapside, London, for a method of applying steam, without pressure, to pans, boilers, coppers, stills, pipes, and machinery, in order to produce, transmit, and regulate various temperatures of heat in the several processes of boiling, distilling, evaporating, inspissating, drying, and warming, and also to produce power.—Dated Jan. 19, 1826.—(*Six months.*)

Sir Robert Seppings, Knight, of Somerset House, London, for an improved construction of such masts and bowsprits as are generally known by the name of made masts and made bowsprits.—Dated Jan. 19, 1826.—(*Two months.*)

Robert Stephenson, of Bridge Town, Warwickshire, engineer, for axletrees to remedy the extra friction on curves to waggons, carts, cars, and carriages used or to be used on railroads, tramways, and other public roads. Dated January 23, 1826.—(*Six months.*)

THE
REPERTORY
OF
PATENT INVENTIONS, &c.

No. IX. MARCH, 1826.

Specification of the Patent granted to WILLIAM LISTER, *of Baildon, in the parish of Otley, in the county of York, Cotton Spinner, for certain improvements in the method and machinery for preparing and spinning wool, silk, mohair, or other animal fibre, of any quality or length of staple.* Dated January 16, 1823.

WITH AN ENGRAVING.

TO all to whom these presents shall come, &c. &c. *Now know ye,* that in compliance with the said proviso, I, the said William Lister, do hereby describe and ascertain the nature of my said invention by the following description thereof; and the manner in which I perform the same, by the figures and drawings annexed (that is to say):—My said invention doth consist in an apparatus for straightening the fibre of and spinning wool into worsted, yarn, or the like and other animal substances, such as silk and mohair, into yarns, by wetting, pressing, or partly drying and calendering the sliver or slivers in its or their progress, from the bobbin or bobbins to the fly of the roving spindle, and without employing the process commonly called combing.

DESCRIPTION OF THE DRAWINGS.

The drawings marked A (Pl. VIII.) is a side elevation of a drawing or roving frame, in which the parts coloured blue represent my said improvements: B B B are three bobbins, mounted in the usual way, and containing slivers of wool: R is a small roller, partly immersed in a shallow cistern, W, of hot or cold water: P P are two plain rollers, the upper one resting on and moving with the under one. In order to cause a pressure between these two rollers, a weight is hung on the axis of the upper one. It will be seen by this arrangement, that if the slivers, S S S, from the bobbins, B B B, are drawn under the roller, R, they will pass through the water in the cistern, W, and will be thus wetted, which is the first process to be performed by my said improvements. If the slivers are then drawn between the rollers, P P, a weight being hung on the axis of the upper one, as before described, the greater part of the water will be pressed out of the slivers, which is the second process to be performed by my said improvements. D, *c c*, and D, are the drawing and carrying rollers now in use. If the slivers, after leaving the rollers, P P, are then passed between the drawing and carrying rollers, in the usual manner, they will arrive at cylinders, K K K K, the two lower of which are hollow, and which I call the calendering rollers; the two upper of these rollers are also pressed upon the under ones by weights on their axis. The surfaces of these rollers are perfectly smooth and true, and the under ones are made hollow, and heated by steam or otherwise (but I prefer steam), which is driven through them, and the effect of passing the previously moistened slivers between them is to calender or hot-press them, so as to take out the curl or frizzle from them to any degree of smoothness required, which is the third and last process to be performed by my said improvements; for immediately on leaving the calendering rollers, K K K K, the slivers are passed through the top of the roving spindle, Q, and so twisted and formed into a new roving, in the ordinary way. The first motion is given to the machinery in the usual way, by means of the pulley, Y, over which a band is to be passed, and communicating with any competent power, such as a steam-engine, water-wheel, or the like. On the same axis with the pulley, V, is a long drum, M, over which bands pass to communicate motion to the roving spindles; and also a pulley, X, which communicates motion by means of a band to the pulley, Z, which is on the end of the second calendering roller, K. This calendering roller communicates motion by means of the wheel on its opposite end to all the remaining rollers, except the wetting roller, R, which is turned merely by the friction of the slivers passing under it, as will more fully appear by reference to the drawing marked B. The drawing marked B is a plan of a part of a drawing or roving frame, in which those parts coloured blue represent my said improvements. I call this the plan of a part of a drawing or roving frame because, in order the better to show the direction of the slivers, the upper rollers are omitted. W is the shallow cistern of water before-mentioned: B B are bobbins on which the slivers are represented as wound; R R are what I call the wetting rollers, from their being partly immersed in the water, and thus wetting the slivers as they pass under them: P P are the pressing or drying rollers: D, C C, D, are the drawing and carrying rollers now in use, as before described: K K are the calendering rollers: O O are the fliers of the ordinary roving spindles; the red lines represent the slivers: N N are guides. The ends of the calendering rollers are represented with screws, for the purpose of attaching the necessary apparatus for causing steam to pass through them. The supply of steam being regulated by a cock or valve, it may be either finally condensed or conducted out of the building, as may be most expedient. Having traced the motion, when describing the drawing marked A, as far as to the pulley, Z, on the end of the calendering roller, I will now continue to trace it to the other parts of my apparatus. The end of the second lower calendering roller, opposite to where the pulley, z, is fixed, is provided with a cog wheel, which, by means of the connecting wheels on dead centres, *g g*, communicates motion to the first calendering roller, and thence to the second drawing roller, D. These connecting wheels, *g g*, are arranged to allow just so much increased velocity to the calendering rollers as will keep the slivers tightly stretched; from the lower second drawing roller motion is communicated to the first drawing rollers, and from thence to the carrying rollers, in the usual manner: then, to give motion to the pressing rollers, P P, I place an additional wheel, *a*, on the axis of the first lower drawing roller, which, by means of the connecting wheel on the dead centre, *e*, communicates motion to the large wheel, *f*, on the axis of the lower pressing roller, P. Of the upper rollers generally I need only say, that they move by friction only on the lower rollers, except indeed the upper calendering rollers, which are provided with cogged wheels to work in the wheels, J J, seen on the under calendering rollers, and which are used for the purpose of making their motions steady and uniform. Now the exact dimensions and proportions of my said improvements are not material to the invention, and they may be made of whatever materials may be deemed most expedient by the manufacturers; nor is the particular mode of applying water to wet the wool, &c. or heat the calendering and other rollers, whether by steam, or heaters, or otherwise, at all material, provided always that they are moistened and heated to the requisite degree and temperature for hot pressing; but an apparatus, which will straighten the fibre of and spin wool and worsted, yarn, or the like, and other animal substances, such as silk and mohair, into yarns, without employing the process commonly called combing, and in manner aforesaid, being, to the best of my knowledge and belief, entirely new, and never before used in this kingdom, I hereby declare this to be my specification of the same, and that I do verily believe this said specification in all respects fully, and without reserve or disguise, to comply with the proviso in the said hereinbefore in part recited letters patent contained, whereby it is my intention to maintain an exclusive right and privilege to my said invention.*

In witness whereof, &c.

Specification of the Patent granted to MARC ISAMBARD BRUNEL, *of Bridge-street, Blackfriars, London, Esq. for certain mechanical arrangements for obtaining powers from certain fluids, and for applying the same to various useful purposes.* Dated July 16, 1825.

WITH AN ENGRAVING.

TO all to whom these presents shall come, &c. &c. *Now know ye,* that in compliance with the said proviso, I, the said Marc Isambard Brunel, do declare that my invention of certain mechanical arrangements for obtaining powers from certain fluids, and for applying the same to various mechanical purposes, is described in the following specification. The fluids or liquids, from which the powers in question are to be obtained, are those that result from the condensation of certain gases, which at the ordinary pressure and temperature of the atmosphere always remain in the gaseous or aëriform state. There are several gases which come under this description, some of which are treated upon by Mr. Faraday, in the papers read before the Royal Society of London, in 1823. I give the preference to carbonic acid gas. This gas, at the temperature of freezing water, requires a pressure of about 30 atmospheres to condense and retain it in a liquid state. It may be obtained by decomposing any carbonate by the action of any of the common acids. The mode of obtaining the liquid from the gas is by forming the gas under a gasometer, and condensing it afterwards, by means of a condensing pump, into a vessel, and continuing the operation until it passes to the liquid state. Having explained the way of obtaining the gas and the liquid resulting from it, I shall proceed now to describe the various parts of the mechanical arrangements intended for obtaining the power, and applying it to various mechanical purposes. These mechanical arrangements consist chiefly of two cylindrical vessels, denominated receivers, into which the liquid has been previously formed by the action of the pump. One receiver is shown at A A, and the other, A′ A′, figs. 5 and 6 (Pl. VIII.) The fig. 1, A A, is an enlarged section; and fig. 2 a plan of the same; the same letters designate the same things in the different figures. The communication from the pump to the receiver is through the orifice, O, fig. 1, which can be stopped at pleasure by the plug or stop-cock, P, figs. 1 and 2. When the receiver has been charged with the liquid and closed, a pipe, D, is applied to it at K, figs. 1 and 2, and connected at X with a vessel, denominated the expansion vessel, B B, figs. 3 and 4: L L, figs. 1 and 3, is a lining of wood, or other non-conductor of heat, to prevent the absorption which would otherwise be occasioned by the thick substance of the metal. This expansion vessel is connected through a pipe, G, figs. 3, 5, and 6, to a working cylinder represented at H, figs. 5 and 6. The figs. 5 and 6 represent two receivers, A A and A′ A′, connected with the working cylinder, H, through the intermediate expansion vessels, B B, B′ B′. The figs. 3 and 4, B B, represent an expansion vessel on an enlarged scale. These vessels contain oil, or any other suitable fluid, shown at *b b*, fig. 3, as a medium between the gas and the piston, Q, fig. 5. Before explaining the action of these parts, I shall describe how the power is obtained in the receiver. The receiver consists, as represented in fig. 1, of a strong metal cylinder, in the interior of which there are one or more thin metal vessels. Tubes are most convenient as represented at T T T, figs. 1 and 2; the joints of these tubes, through the top and bottom of the receiver, are made perfectly tight; this I do by packings rather than by soldering. The use of these tubes is to apply alternately heat and cold to the liquid contained in the receiver, without altering very sensibly the temperature of the cylinder. The operation of heating and cooling through the thin tubes, T T T, figs. 1 and 2, may be effected with warm water, steam, or any other heating medium, and cold water, or any other cooling medium. For this purpose the tubes, T T T, fig. 1, are united at the top and bottom by a chamber and cock, C C C C. By the opening of these cocks with the pipes, E E, hot and cold water, which I propose here to use, may be alternately let in and forced through by means of pumps. The cocks may be worked as steam-cocks are worked in some steam-engines. Now, if the hot water, say at 120°, is let in through the tubes of the receiver, A A, figs. 5 and 6, and cold water at the same time through the receiver, A′A′, the liquid in the first receiver will operate with a force of about 90 atmospheres, while the liquid in the receiver, A′A′, will only exert a force of 40 or 50 atmospheres. The difference between these two pressures will therefore be the acting power, which, through the medium of the oil, will operate upon the piston, Q, in the cylinder, H, fig. 5. It is easy to comprehend that, by letting hot water through the receiver, A′A′, and cold water at the same time through the opposite one, A A, a re-action will take place, which will produce in the working cylinder, H, an alternate movement of the piston, Q, applicable by the rod, I, to various mechanical purposes, as required. It is to be observed that the use of the gasometer and of the forcing pumps is simply for obtaining the gas, and for charging the receivers with the liquid. When the receiver is once charged, and has been closed with the stop-cock, P, fig. 1 and 2, the gasometer and forcing pumps are to be disconnected from the receiver by unscrewing the pipe, D, at the screw joint, K, figs. 1 and 2. The same pipe may, however, be used as the means of connecting the receiver with the expansion vessel, or another suitable pipe may be substituted to it at the orifice, o, fig. 1, and the other extremity adapted to the expansion vessel at x and x', figs. 3, 4, 5, and 6. I have intentionally avoided adopting two distinct pipes to the receiver, viz. one for the pumps, and another for connecting the receiver with the expansion vessel, because, if there were two orifices, two stop-cocks would be necessary, which should be avoided. It is obvious that there is no difficulty in connecting the forcing pump with both receivers, as the small pipes used for that purpose may be made to reach either. In the mechanical arrangements for obtaining powers from the liquids when formed, I claim, as my invention, the application of the receiver, as it is before described, the essential part of which is the internal application of the vessel or tubes destined to convey the heat and cold. Their form and the manner they are applied render them capable of resisting the intense external pressure of the liquid, and yet admit of their being made so thin as to allow of the rapid and complete transmission of heat and cold through them to and from the liquid; and I further claim the arrangements by which the receivers, acting in opposition to each other, produce, without any aid of intermediate valves, an alternative action, which may be applied to various mechanical purposes.

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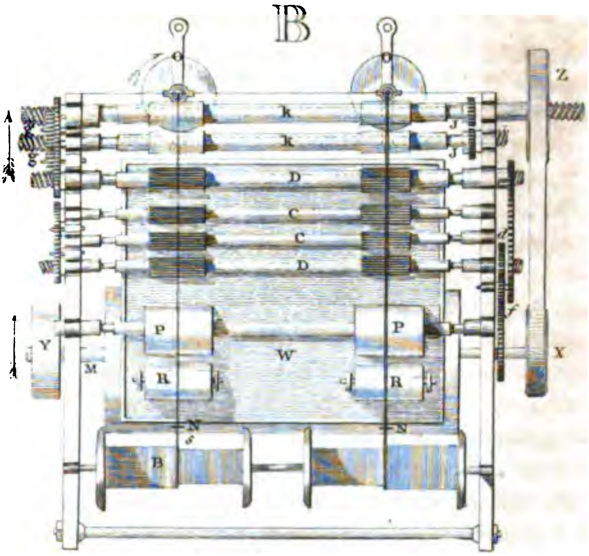
* This patent has been repealed by writ of *scire facias,* Jan. 19, 1826.

In witness whereof, &c. &c.

Specification of the Patent granted to Thomas Hills, *of Bromley, in the county of Middlesex, Merchant, and* Uriah Haddock, *late of the City Terrace, City Road, in the county of Middlesex, and now of Saville Place, Mile End Road, in the said county of Middlesex, Chemist, for an improvement in the manufacture of sulphuric acid.* Dated May 19, 1818.

TO all to whom these presents shall come, &c. *Now know ye*, that in compliance with the said proviso, we, the said Thomas Hills and Uriah Haddock, do hereby



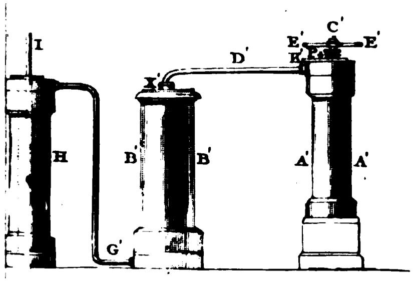
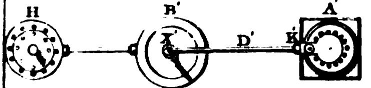


Fig. 6.



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describe and ascertain the nature of our said invention by the following description thereof (that is to say):—From the well known fact that in the common method of manufacturing sulphuric acid a very imperfect combustion of sulphur is effected, and in consequence thereof a considerable portion of the product of that combustion, instead of becoming condensed sulphuric acid, evaporates, and is wholly lost, and the residuum of the articles employed become of little or no value to the manufacturer. And also upon the discovery which we have made, that sulphuric acid can be manufactured from metallic and other sulphurets, or any other substance or substances in which sulphur is contained in a state of chemical union, and the residuums of such sulphurets or other substances be converted into articles of valuable consideration in commerce, we have established and adopted the following operations, viz.:—In the first instance we do employ one or more vessel or vessels for the purpose of combustion, and another or others for the purpose of effecting the condensation into sulphuric acid. Secondly, we do ignite metallic or other sulphurets, or any other substances in which sulphur is contained, in a state of chemical union, in one or more vessel or vessels, for the purpose of combustion, in such manner that there be a sufficient supply of atmospheric air or other imponderable substance or substances containing oxygen, capable of being extracted by sulphur or sulphurous vapour passing through and in contact with the ignited matter in the combustion vessel or vessels; so as to cause such an entire and complete combustion, that very little, if any, sulphurous acid gas shall be produced; the number and capacity of vessels used either for the purpose of combustion or condensation being according to the quantum of article in manufacture from time to time. And during the condensation we do occasionally convey steam in conjunction with atmospheric air, or other imponderable substance or substances containing oxygen as aforesaid, into the condensing vessel or vessels, and thereby assist in securing a more perfect condensation into sulphuric acid than by any other means hitherto in practice. Having thus specified the general principle of our invention, we do now proceed to make known the several manipulations and other parts of our process in such manner as to be comprehended by any competent workman, or other person or persons acquainted with the general course and nature of chemical operations, viz.—To effect the combustion we employ a furnace or furnaces, in which we have one or more vessels or cavities so placed that the fire may act upon them, and make them sufficiently hot to assist in causing such an entire and complete combustion of the combustible matter within them, that very little, if any, sulphurous acid gas is produced. The vessel or vessels employed for the combustion are either metal, earthen, or any other substance that will bear the heat required to aid and assist the causing such entire and complete combustion of such combustible matter, and which vessel or vessels shall be capable of withstanding the action of sulphuric or other gas produced, and the number and capacity of them are to be varied according to the capacity of the receiving vessel or vessels, into which the gas is conveyed for condensation. The receiving vessel or vessels are connected with the combustion vessel or vessels by pipes, passages, or other medium, properly constructed for the conveyance of the gas and atmospheric air, or other substance or substances containing oxygen as aforesaid, into the condensing vessel or vessels. The opening or openings in the combustion vessel or vessels at which sulphurets or other substances, in which sulphur is contained as aforesaid, are introduced, are so constructed as to be kept closed or open, as occasion may require, during the operation of combustion. And our process is, after putting the charge of sulphurets or other substances, in which sulphur is contained as aforesaid, into the combustion vessel or vessels, to leave open either wholly or in part the aperture or apertures by which such charge was inserted, in order that the atmospheric air, or other substance or substances containing oxygen as aforesaid, may enter and mix itself with the materials, and assist in the combustion of them, and by passing with the gas into the receiving vessel or vessels, accelerate and aid the condensation; and such aperture or apertures we continue either wholly or in part open, until any reaction or escape of gas commences, and at that time we close such aperture or apertures; and during the operation we do occasionally convey steam into the condensing vessel or vessels, in conjunction with atmospheric air or other imponderable substance or substances, containing oxygen as aforesaid; and finally, we do leave the condensation of the gas to take place.

In witness whereof, &c. &c.

On Areometers for saline liquids and other fluids.

Communicated by Mr. J. C. Gamble, Liffybank Vitriol Works, Dublin.

WITH AN ENGRAVING.

Of late years, since manufacturers begun to call in the aid of science to direct their processes, the hydrometer has become a most useful and efficient instrument in their hands.

I believe the first correct hydrometer of which an account has been handed down to us is that of Fahrenheit; and most of those employed since his time bear to his a resemblance more or less remote. By the addition of weights, it is made to float at a mark made upon the stem, in the fluid under trial. As is the weight of the instrument, with its additional weights, when poised in any fluid, to the weight of the instrument, &c. when poised in distilled water, so is the specific gravity of the former to the latter fluid.

The late Wm. Nicholson (a most indefatigable labourer in the field of useful science), greatly improved this instrument by attaching weights to its lower extremity. This contrivance enabled him to ascertain by it not only the specific weight of the lightest and heaviest fluids, but also of all solid bodies. His instrument being constructed of brass, becomes corroded by the contact of acid or saline solutions. This objection, as well as that arising from its great expense, renders it unfit for the every-day business of practical chemistry.

Various other expedients have been employed from time to time for ascertaining the specific gravity of fluids, to which we think it unnecessary here to advert, because they are commonly known, but more especially because we think them too complex to be useful to the manufacturer, for whom our observations are principally intended. But we may just observe, that Beume's hydrometer is in universal use in France, and that the principle and practice of its construction are so extremely defective, that scarcely two authors have agreed in attempting to reduce it to the standard of specific gravity.

During a late visit to London, I had occasion to inquire for a hydrometer or aerometer for salts, and was disappointed to find that one constructed on correct principles could not be met with. This is the more surprising, as the instrument I am now about to describe has been in use in Scotland, Ireland, and about Manchester, for the last twenty-five years. And so indispensable a companion is it in the management of liquid processes, that the manufacturer accustomed to its use would feel himself involved in darkness if deprived of the use of it for a single day. It is his pilot to definite results; to use it is but to immerse it in the liquid; multiply by five the number corresponding with the surface of the liquid; place the figure I before the product, and this is the specific gravity.

It was first constructed by a poor tippling glass-blower in Glasgow, whose name was Twaddle. Hence it is called Twaddle's hydrometer. The philosopher, whoever he was, who first pointed out the principles of its construction, has conferred a most important service on practical chemistry.

I have been in the habit of graduating it for the use of my own manufactory for many years, and give publicity to these remarks, that the manufacturer or the tradesman may be able to avail himself of my experience. The glass-blower will supply the tubes, with the bulbs ready formed, at 9*s.* per dozen; and when the precautions in the graduation pointed out below have been rigidly attended to, I have never found it erroneous one fourth of a degree, an error infinitely too trifling to affect the results of a manufacturing process.

This areometer is composed of six distinct tubes, with their bulbs, each resembling the hydrometer of Fahrenheit. The lower or counterpoise bulb is about three-fourths of an inch in diameter. The neck between the bulbs should be strong, and from half an inch to an inch in length. The upper or poise bulb is about an inch and three-eighths in diameter. The upper stem is about five inches in length, and three-sixteenths in diameter, and the entire instrument from seven and a half to eight inches in length. The six glasses are numbered, commencing with No. 1, the lightest which floats in pure water, and ending with No. 6, the heaviest, which reaches strong sulphuric acid. The six scales are divided into 170 equal parts or degrees, and these again are subdivided by dots into half degrees. The first three numbers contain 72 degrees, or 24 each; the fourth number ranges from 72 to 102, containing 30 degrees; the fifth from 102 to 136, containing 34; and No. 6 from 136 to 170, also containing 34 degrees.

I shall now proceed to describe the mode of graduating glass No. 1, and as the details are the same with respect to all the others, I shall not repeat them. Provide a hydrometer, containing the six numbers, whose accuracy has been proved, that it may be relied on as a standard. With this prepare, before-hand, the solutions of the specific gravity mentioned below. Provide also, four glass jars, ten inches in depth, and two and a half in diameter; a piece of stout wire, about a foot in length; some sealing wax, broken in pieces about the size of small shot; slips of writing paper, half an inch in breadth, and longer than the stem of the glass. Draw a fine hair stroke at one end of each paper at right angles to its length. Fold the papers round the iron wire, to give them a tubular form and facilitate their passage within the glass stem. Make a mark with a fine file at the lower end of each stem to be graduated, about half an inch above the bulb. Fill nearly to the top your four jars, three with solutions of common salt and water, at the specific weights of 24, 16, and 8; and the fourth with pure water, indicating 0, all at the exact temperature of 62. Introduce mercury by a dropping glass into the lower bulb of your tube, till it sinks in the liquid, No. 24, nearly to the mark on the stem; introduce one of the cylindrical papers till the mark on it exactly corresponds with that on the stem. Now cautiously add small pieces of the broken sealing wax, till the paper mark exactly corresponds with the surface of the liquid. With a fine pen make a mark on the paper, on a level with the top of the stem. Withdraw the instrument from No. 24, wash and dry it, and immerse it in No. 16. Draw up the paper till the mark is on a level with the surface of the liquid as before; make another mark on the paper under the former one, and at the same part of the glass. Proceed in this way till you make the mark in the jar containing water, when this part of the graduation of No. 1 is finished. Withdraw the paper thus marked, and transfer the divisions to another piece of paper in a straight line, and have each division subdivided into eight equal parts. Let the permanent scale be now got ready; it may be about three-fourths of an inch in breadth, and a little longer than the divisions to be marked on it; and let the 24 divisions be laid down upon it, subdivided by dots, and numbered, as shown in fig. 1. Give it a tubular shape, as before directed; introduce it within the stem till No. 24 corresponds with the mark on the glass; secure it in its place by a small piece of sealing wax; replace the glass in the liquid, No. 24, and continue to add small pieces of sealing wax till 24 on the scale corresponds with the surface of the liquid. Close the top of the glass with the blow-pipe, and the instrument is finished. The remaining five glasses are completed in the same manner, only changing the specific gravity of the liquids.

I omitted mentioning in its proper place, that in graduating the permanent scale, the divisions must be inverted; that is, the first divisions marked off at the top of the temporary scale must be made the lowest on the permanent one. The reason is sufficiently obvious.

Solutions of common salt answer well for graduating Nos. 1 and 2, viz. to No. 48 on the scale; but for the other four it will be necessary to have recourse to sulphuric acid.

The most scrupulous accuracy and circumspection are requisite on the part of the artist in preparing his solutions. It is the most troublesome part of the business, and on its accurate performance his success will ultimately depend. No less than twenty-two graduated solutions are requisite for completing the instrument, one for every eight degrees.

It is on this account that a correct set of the instruments are recommended as standards, to prevent the vexatious delays attendant on a weighing bottle. The acid solutions should be prepared before-hand, as heat always results from the mixture of water with sulphuric acid; and when a solution in actual use requires correction, it should be done with acid near its own strength. While the work is going forward, the temperature of the apartment and of the solutions should be preserved steadily at 62. Much deviation to either side will produce a corresponding error on the scale. Indeed, while the process of graduation is on hand, the thermometer and hydrometer should be objects of perpetual reference. The operator must be careful to wet the stem of the instrument a little above where it naturally floats, else it will be buoyed up, and the liquid appear heavier than truth; on the other hand, the stem must not be too much wetted, or the liquid will appear lighter than it ought.

The practised artist will no doubt smile at the long spun detail of trifling minutiæ we have here submitted to. But the recollection of the many mishaps and disappointments that attended my own early essays, induces me to think that small particulars are useful tools in the hands of the young experimentalist.

As much of the time attending the construction of this instrument is expended in graduating the liquids, there will be obviously much economy in preparing a large number at once. It may be well to mention that Rankctli and Agnew, of Manchester, construct these areometers with great neatness and accuracy.

I have never heard that an instrument on this principle has been constructed for fluids, lighter than water; nor do I know any reason why it has not. Besides being much more simple, it would possess other advantages over those in common use. Two glasses, without weights, would comprehend the entire range, from water to the strongest alcohol.

As soon as I can inform myself on this latter branch of the subject, I may take occasion to revert to it.

Reference to the Engraving.

Fig. 7 (Pl. VIII.) represents the scale, before put into the stem.

Fig. 8, the entire glass, when finished.

Plan for making a Cut across the river Thames, at the Horse Ferry, Rotherhithe, and for putting down into it a Wooden Tunnel, of 16 feet diameter from cut to cut, and 14 feet diameter within.

By Mr. R. Trevithick.

Abstracted from the Papers and Documents of the "Thames Archway Company."

The cut across the Thames is to be made beneath the water by a steam ballast-raising engine, 24 feet deep below the bottom of the river, and wide enough to receive the wooden tunnel, and with its sides sloped in an angle of about 45 degrees. This cut is to be nearly horizontal at the middle of the river, but declining about 6 inches towards the South, for delivering the water from the road down into the drift; the remaining parts at each side are to be inclined one foot in fourteen, which is about the degree of inclination of the bottom of Holborn-hill.

This slope will ascend to the surface at the South side, about 100 feet South of the shaft, and at the North side about 150 feet North of Queen-street, in the field adjoining to the Commercial Road; making the total length of the tunnel about 2010 feet.

All the earth that is above low water mark may be removed with spades.

The wooden tunnel, for which this cut is to be prepared, is to be made of elm, in lengths of from 180 to 200 feet of six inch plank, placed two in thickness, or in two layers, laid so that the joints shall be covered by the planks in the other layer, fastened together with trennels, hooped outside with iron, caulked, pitched, and made water-tight like a ship. The hooping to be put on in a spiral form, with the spirals two feet asunder.

The ends of each length of the tunnel are to be made to fit into each other, or to be put together with cast-iron ferrules, of 6 feet long, similar to the joints of a flute.

Each of these wooden cylinders will weigh about 200 tons, and may be moved in water nearly as easily as a loaded barge. As many of these cylinders are to be prepared as will extend from side to side of the river above low water mark, when joined end to end, which will be about 1340 feet. From each end of the wooden tunnel to the entrances, the passage is to be left at intervals open to the surface, to admit light, and is to have both its sides and bottom constructed of brick-work, 18 inches thick. This part will extend about 670 feet (at each side), and will complete the tunnel from the surface at one side of the river to that at the other. Staircases for descending into the tunnel are to be formed at each side; the interval of the tunnel between these, which will be about 876 feet, must be lighted by lamps always; the remaining 464 feet (at each side) will receive day light through apertures made like wells from the surface, at intervals of about 30 feet from each other.

After the cut is excavated, piles are to be driven at its eastern side, about 60 or 70 feet asunder, to guide the wooden tunnel into its place. Then the wooden cylinders (which are intended to be made near the Surrey Docks) being ready, are to be rolled into the docks from the banks, and to be towed to the cut, a little before low water, when there is little or no tide; being previously loaded with rubbish sufficient to sink them, but kept buoyant by empty casks attached to them. Here they are to be placed across the river, resting against the piles above-mentioned, their ends to be joined into each other, and to be drawn tight together by a rope or chain, put through them from end to end.

At extreme low water the lashings or cords are to be slipped from the casks, and the cylinders are to be let to sink altogether to the bottom of the cut, which is to be then filled up with strong clay, well rammed down, even with the bottom of the river. A hole is then to be bored into the bottom of the tunnel from the roof of the drift (which is to be previously dug beneath the cut), to let the water down from the tunnel to the well of the steam-engines.

When the tunnel is drained, it will have a great tendency to float, but having an average of 8 feet of clay above its top, with the weight of the road inside, its buoyancy will be overbalanced. If, after a number of years, the wooden cylinders decay, they may be easily replaced by putting cast-iron cylinders, one inch and a quarter thick inside; and if any difficulty is found in letting down the whole of the cylinders at one time, they may be put down separately, and afterwards be joined together beneath the water.

ESTIMATE OF COST.

	£.
Moving stuff by the ballast engine from the cut, 649 feet long, 56 feet wide at top, and 24 deep, sloped 45 degrees at sides, estimated at 3000 tons (from various circumstances), at 3*s*. 6*d*. per ton, the price given at the East India Docks....	5250
Cutting from low water mark to the first light well at both sides, 690 feet long, 80 feet wide at top, and 36 deep, about 45,000 tons, at 2*s*..........	4500
Cutting from said light wells to each entrance, 640 feet long, about 30 feet wide, and 12 deep, estimated at 6500 tons, at 1*s*. 6*d*.	487
Wooden tunnel, 1340 feet long, 16 feet diameter from out to out, 1 foot thick, estimated 94,470 feet, of rough elm, or 2362 loads, at 7*l*. per load..........	16534
Making, caulking, and paving the tunnel, at 2*l*. per load....	4724
Hoop-iron for ditto, half-inch thick, and 3 inches wide, 150 tons, at 30*l*.	4500
Brick-work from the ends of the tunnel to the entrances, 640 feet long, about 14 feet deep, and 18 inches thick, 1600 square yards, at 55*s*.	4400
Brick-work of two staircases, 18 feet diameter, and 7 light holes, 6 feet diameter, 335 square yards, at 50*s*..........	837
Covering the tunnel with 60,000 tons of clay, at 1*s*. per ton....	3000
Piles and sundry other timber for the works	500
Making and paving the road, 2010 feet, at 30*s*..........	3015
Lamps at every 30 feet, 67 lamps and irons, at 50*s*. each....	167
Steps of two staircases (exclusive of brick-work)	200
Iron railing for the footpath, at 4*s*. per foot..........	800
Bringing and fixing the wood tunnel in its place, with ropes, anchors, boats, &c..........	500
Two sets of gates and buildings at entrances	500
Purchase of two houses and land at South side, and 2 houses, 2 yards, and a field at North side	1500
Keeping the engine at work one year, attendance, agency, &c. at 50*l*. per week..........	2600
Incidental charges, 10 per cent. on the whole amount.......	5400
	£59464

Of Lime which hardens in water. By M. Hassenfratz.

Among the stones which produce lime proper for building beneath water, or in situations exposed to humidity, the stone of Lena is the most distinguished. Bergman seems to be the first who attended to this species of lime-stone, and who endeavoured to make known its properties. He says, in his "*Opuscules*," that the black lime which is prepared at Lena, in the province of Upland, makes an excellent mortar, which becomes hard much more quickly than common mortar, and even beneath water. This quality, M. Bergman says, appears to proceed more from the manganese than the iron of the stone, since lime-stones deprived of manganese, and charged with a quantity of iron, equal to that contained by the stone of Lena, are of a much lighter colour. There are, in many parts of Sweden, lime-stones which become black in calcination, and which have certainly the same property.

Before having pronounced so decidedly on the cause of the induration of this lime, it would have been desirable that the celebrated professor of Upsal had analyzed this lime-stone, and had made known its constituent parts.

Guyton Morveau, persuaded by the assertion of Bergman, that manganese was the cause of the hardening in the water of the limes which had this property, procured six sorts of lime-stones, which he had been assured were employed with success in subaqueous constructions:—1st, That of Lena, of the province of Upland; 2d, that of Ath, in the Tournay district; 3d, that of Millerai, in Savoy; 4th, that of Morex, in the country of Gex; 5th, that which they employ at Lyons to make *beton;* and 6th, that of Brion, in Burgundy. He calcined these stones, in order to compare their loss by the fire, and the colour which they acquired. He afterwards dissolved them in nitric acid, and then treated them with nitre. The following are the results which he obtained from ten parts of the stones.

Species of stone.	Loss by fire.	Colour obtained.	Loss in nitric acid.	Colour by fusion with nitre.
Stone of Lena.	2·548	Blackish brown.	0·733	Deep green tint.
——— Ath.	2·474	Whitish grey.	1·973	Did not become green.
——— Millerai.	2·888	White.		A little green.
——— Morex.	2·583	Clear brown.	2·017	Traces of green.
——— Lyons.	2·393	White.		
——— Brion.	2·526	Dark brown.	2·109	Plainly green.

As stones containing manganese become brown and black on exposing them to the air, and as they show traces of green when fused with nitre, M. Guyton concluded from these experiments, that of the six species of stone, three contained manganese, namely, those of Lena, of Morex, and of Brion; and that the three others, those of Ath, of Millerai, and of Lyons, did not contain any; and from thence, conformably to the principle established by Bergman, that manganese gave to lime the property of becoming hard under water, M. Guyton considered the stones of Lena, of Morex, and of Brion, as those alone which should be employed in subaqueous constructions; and those of Ath, of Millerai, and of Lyons, as not being proper for the purpose; but as those three last stones really furnished lime which was used with good success in building beneath water, the academician of Dijon observed, that it is possible that two sorts of stones might be found in the same quarry, and perhaps in thin beds, intermingled so as to be separated with difficulty; but in this case the mixture might give a meagre lime, or a lime more slow to harden, and even at first becoming diluted with water, but forming in the end a solid *beton*.

Persuaded, from the observation of Bergman, that manganese was the principal agent in the hardening of lime; and convinced afterwards, by an analysis made in the Polytechnic school, that the lime of Metz contained—

Carbonic acid	39·00
Lime	44·50
Silex	5·25
Alumen	1·25
Manganese	3·50
Iron oxide	3·20
Water	2·25
Loss	1·05
	100·00

M. Guyton mixed four parts of grey clay, and six parts of black oxide of manganese, with ninety parts of good lime-stone reduced to powder.

This mixture having been calcined and cooled, he kneaded it to the consistence of a soft paste with sixty parts of silex.

A ball of the mortar prepared in this manner, and in these proportions, at the sitting of the 29th of Pluviose, in the year 5 (11th Feb. 1797), is still preserved in the laboratory of the Polytechnic school. This ball being thrown, immediately after it was made, into water, became hard, and assumed a specific gravity of 2·231.

Saussure found at Chamouni many quarries of stones, the lime of which became quickly hard, and which might be employed to advantage in constructions under water. Among the stones which he pointed out, he principally distinguished the stone of St. Gingoulph and that of the bank of Piget. The first is cut by black veins, containing manganese, and interspersed by black points equally containing manganese; the second did not afford any signs of manganese, either in being treated with nitre or with acids, but showed plainly indications of iron, in pretty considerable proportions. This observation led him to believe, that manganese was not the only substance which could contribute to the solidification of lime beneath water.

It is most probable, says the celebrated Genevan lithologist, that independent of manganese, the silicious particles which are naturally mixed with some species of lime-stones, contribute to render the mortar made from them more strong and tenacious; for it is certain that the substances which have undergone the action of fire, such as powdered brick, dross of iron, and the pozzolane earths, form, with common lime, cements which resist water better than mortar made with crude sand; from whence it follows, that the particles of quartz, and even of argile, which are mixed with certain lime-stones, and become calcined along with them, when they are made into lime, ought to contribute to the hardness of the mortar that is made from this lime, at the same time that they render it meagre, that is to say, requiring a smaller proportion of sand. This doubtlessly is the reason of the quality of the meagre limes which do not contain manganese. The stone of the bank of Piget, for example, contains 11 per cent. of parts insoluble in acids; that of Planet two and a half only. But the influence of manganese appears to be greater than that of the silicious particles; for the violet veins of the lime of St. Gingoulph, which from experiment produce the strongest lime, contain only four and a half parts of insoluble matter, while the tawny parts, which form the bottom and the least active portion of the same lime, contain fourteen and an eighth.

Smeaton, who was charged with the construction of the Edystone light-house, in England, made many researches into the nature of limes and cements fit for subaqueous erections. In order to determine the best cement, he took the quantity of the different ingredients necessary to form a ball of about two inches in diameter. This ball, left to itself, after having been worked up until it had become sufficiently hard to resist the pressure of the fingers, was put into the quantity of water necessary to cover it entirely, and the effects of this immersion, more or less prolonged, decided the goodness of the composition.

Whatever were the proportions of the mixture of lime and sand in these balls, if they contained no other ingredients, their continuance in the water always destroyed them. The compositions formed of two parts of slacked lime to one part of terras, resisted commonly this proof; but the proportions of equal parts of the same ingredients resisted it almost always.

Mr. Smeaton having heard that a species of lime was raised at Aberthaw, in the county of Glamorgan, which had the property of hardening in water, like terras mortar; procured some specimens of the stone, and calcined them himself. They required much fire for their perfect calcination; the stone was of a dull blue colour, with some shining points; the lime which it produced was of a tawny colour. This lime appeared to have a great advantage over the other when used with the terras, in the two proportions mentioned; and this advantage increased in proportion as the balls were longer preserved.

In essaying the Aberthaw stone with nitric acid, Smeaton remarked that it became dissolved; that the solution was of a dark colour, and much troubled; he found at the bottom a little sand, of which some grains were as transparent as crystal; the earth which troubled the solution, when it was washed and collected in balls, appeared to be a very fine blue clay, which weighed about an eighth of the whole weight of the stone. One of the balls, put into the fire, acquired in it the hardness of a good brick, from whence he concluded that iron entered into its composition. This ball lost, during the baking, a quarter of its weight.

Having collected nine varieties of calcareous stones which produced lime analogous to that of Aberthaw, he dissolved them in nitric acid, and they all yielded clay in different proportions, from 0·06 to 0·20 of the total weight; and the diminution of their weight by calcination varied from a third to a fourth.

He found that the texture, the colour, or the hardness of calcareous stones, are not constant indexes of their quality, as meagre lime-stones. The analysis itself, which shewed in their composition the clay and the sand, although it formed a strong presumption in their favour, was not always a certain indication; but this latter character, joined to the tawny colour of the lime, always announced the true meagre lime. Thus, whether the stone were blue, white, or brown, whether it were hard or tender, if it took in the calcination this colour decidedly, it was good for subaqueous constructions.

The observations of Smeaton, and those of Saussure, persuaded many scientific men that manganese was not essentially necessary to the composition of limes proper for forming mortar which hardens beneath water. Many believe that, as metallic oxides have a great effect in causing mortar to dry, iron oxide might supply the place of oxide of manganese; and that we might thus attribute to the oxide of iron the solidifying action of many limes which did not contain manganese.

Collet Descotils, in analyzing the lime of Senonches, which is used at Paris with some success in subaqueous constructions, remarked that it contained, independently of lime and carbonic acid, a fourth of silex, extremely fine, with a small proportion of magnesia, alumen, and iron. This silex, says Descotils, which is not attacked when the calcareous stone of Senonches is dissolved in the acids, becomes almost entirely dissolved, when the lime made from this same earth is submitted to their action; the silex ought consequently to exist in the lime in a state fit to receive the action of chemical agents; and it is very probable that it contracts, by the addition of water, an intimate union with the lime, an union which ought to be less attackable by the action of the atmosphere or of water, than the lime by itself. The large proportion of silex also explains why meagre lime swells less in slacking than rich lime.

After what has been observed, it seems very probable that an essential condition for a calcareous stone to furnish a good meagre lime is, that it should contain a large quantity of siliceous matter dispersed through it in very fine particles; for it appears little likely that the very small proportions of alumen, of magnesia, and of iron oxide, which are found in it, should have such a remarkable influence on its properties.

Being desirous to know the nature of the component parts of the lime of Senonches, we requested M. Girard, engineer in chief of bridges and highways, to procure for us a specimen of this species of lime, which we analyzed before we knew of the analysis of it made by M. Descotils, engineer in chief of mines. We found it to be composed of 79·35 lime, 9·50 silex, 9·80 alumen, and 1·35 oxide of iron; and as our stone was in the state of lime, we may conclude that the proportion of silex would only have been 00·57, if we had analyzed the stone itself. M. Vitalis, who had analyzed the lime of Senonches before us, had found in it 0·12 alumen, 0·16 silex, and 0·02 iron. This result agrees pretty well with that which we obtained, to nearly the proportion of alumen; but it differs too much from that of M. Descotils, not to make it desirable that the analysis should be again repeated.

To be continued.

Memoir on Urao (Carbonate of Soda). By MM. MARIANO DE RIVERO *and* J. B. BOUSSINGAULT.

(Translated from the Spanish of a paper published at Bogota, in 1824, at the Printing-office of the Republic of Columbia.)

From the Annales de Chimie, tome xxix. *p.* 110, *Mai,* 1825.

To the South-east of Merida, at a day's journey distance from this town, in the direction of Grita, there is a little village of the Indians, named Lagunillas, from its being situated at a small distance from a little lake, from whence the natives have extracted, for a great number of years, a salt named in that country urao.

The little lake or pool in question is about 1000 metres long, and 250 wide. Its greatest depth is not three metres. It is situated in an argillaceous soil, which contains large fragments of secondary free-stone (*grès*). We have calculated, from a barometrical observation, that the height of the lake is 1013 metres above the level of the sea.

To extract the urao, the Indians form beneath the water an excavation, of several metres in length, and plant in it a stake of from 14 to 16 feet long, the upper end of which rises above the level of the water. When this preparatory labour is finished, an Indian, supporting himself on the first stake, directs another towards the mine in a certain inclination; immediately a second Indian, sliding down the sloping stake, plunges beneath the water, and after remaining down a few minutes, returns to the surface to bring back some fragments of the salt. According to the information which we received, there is found, before reaching the bed of urao, whose thickness is inconsiderable, a metre of mud, and a bed containing many crystals of carbonate of lime. The water of the lake is but very little salt, and the beasts drink it with pleasure.

The urao is crystallized in prismatic needles, which appear to diverge from a common centre; its appearance is vitreous; its hardness is a little inferior to that of carbonate of lime; its taste is alkaline, and like that of carbonate of soda; it does not effloresce in the air.

(We pass over the details of the analysis to give only the results, which were)—

Carbonic acid	0·3900
Soda	0·4122
Water	0·1880
Foreign matters and loss	0·0098

This salt then contains more carbonic acid than the carbonate, and less than the bicarbonate of soda.

The carbonate of soda named *trona,* which Klaproth analyzed, and which comes from the province of Sukena, situated near Fezzan, in Africa, has a great analogy to urao. The results of the analysis of the Berlin chemist were—

Carbonic acid	0·3900
Soda	0·3800
Water	0·2300

The salt of urao is used in this country to give a little pungency to an extract of tobacco, which, placed in the mouth, excites the saliva; this preparation is called *chimo* or *moo.* At Merida they mix four *arobas* of urao, with eight of tobacco. At Varenas the proportion of urao is only equal to a fourth of that of the tobacco. The moo contains less urao than the chimo (see tome xi. p. 432, of a description of the same lake, by M. Palacio).

On the existence of Iodine in the Water of a Salt Spring, in the province of Antioquia. By Mr. J. B. Bousingault.

From the Annales de Chimie, tome xxx. *p.* 91.

A liquor has been brought over from the province of Antioquia of a yellow colour, a sharp taste, and having a marked odour of sea water. This substance, which is used with success as a remedy for the goitre, is named the *aceyte de sal* (oil of salt), doubtlessly on account of its consistence. It was easily ascertained that the *aceyte de sal* was a saturated solution of the hydrochlorites of soda, of lime, and of magnesia; but as hitherto iodine has been the only specific known against goitrous affections, I thought that it might be contained in it; and I have, in effect, convinced myself of its presence, by the following experiments.

On treating the *aceyte de sal*, placed in a retort, with sulphuric acid, abundant vapours of hydrochloric acid were disengaged; and on heating the retort afterwards, it became filled with the violet-coloured vapour peculiar to iodine.

The solution of starch did not at first occasion any change in the *aceyte de sal;* but by the addition of some drops of sulphuric acid, it exhibited a beautiful deep blue colour. The necessity of adding sulphuric acid indicated that the iodine is not in a free state, but probably in the hydriodic state, and forming a hydriodate (salt). The presence of iodine in the *aceyte de sal* is the more remarkable, as this latter substance is nothing else but the mother water produced at the salt work of Guaca, situated in the Cordillieres, which separates the river Magdalena from the river Ranca, and at a great distance from the coast. At the salt work of Guaca the salt is obtained by evaporating the salt water almost to dryness. The salt thus obtained has a sharp very disagreeable taste, and is impregnated with a liquor of an oily appearance. To free the salt from it, they put it in cones of earthen ware, placed with their bases upwards, and pierced at their points. The mother water runs through and falls into vessels placed beneath the cones. This operation much resembles the claying of sugar.

The salt, when once well drained, is exposed to sale, and consumed in the country; I have ascertained that it contains a scarcely sensible portion of iodine; nevertheless, its antigoitrous properties cannot be doubted, for in the countries in the vicinity of the salt work, and where the salt is consumed, the goitre is unknown, while at a greater distance, in the same Cordilliere, this infirmity appears every where.

Not having travelled over the province of Antioquia, I cannot positively affirm at what geological epocha the salt spring of Guaca was formed; but from some indications, and more especially from the nature of the rocks of this province, I will endeavour to give some idea of this matter.

The predominant rock in Antioquia is syenite, which in some places runs into grunstein; the rich mines of gold of this province exist generally in this syenite grunstein. The gold is often found disseminated in porphyretic grunstein, and sometimes also in the veins of granulated quartz. In some places gneis is seen coming out beneath the syenite, which last is in correspondence with the granulated lime-stones and the black schisti, which without doubt are, as well as it, an intermediate formation. This formation, which appears to constitute a great part of the valley of Cauca, bears here and there depositions of a more recent origin, as, for example, the ancient red grit. The salt spring of Guaca is situated in a branch of the Cordillieres, which separates Madelena from the river Cauca. It is probable that it appertains to (the period of) the depositions of gypsum of an ancient date; some anhydrous gypsum and schistous coal, collected at Guaca, leave little doubt in this respect, and render it extremely probable that at Guaca, as well as at Cipaquira, Tausa, Cumaral (the Llamos of Saint Martin), the saliferous earth reposes immediately on the ancient red grit. The presence of the same salts in the mother water of Guaca, as those which are found in sea water, led me to examine it chemically. To its properties already described, I will add that the mother water of Guaca lightly reddens the tincture of turnsol, and that it weighs 1·2349. The salts of barytes do not, when put in it, indicate any sulphuric acid.

Thirty grams of the mother water being evaporated to dryness, and the residue being kept at a red heat for some time, left 8·07 grams of saline matter.

These 8·07 grams, treated with water, left undissolved 0·58 of magnesia, and 0·04 of red oxide of iron.

The lime was separated from the solution by oxalate of ammonia: the oxalate of lime, decomposed by iron, and treated with sulphuric acid, gave 3·43 grams of sulphate, representing 1·42 of lime. The liquor deprived of lime did not contain any magnesia; 4·58 of hydrochlorate of soda was extracted from it. This hydrochlorate being dissolved in a proper proportion of water, and mixed with a concentrated solution of sulphate of alumen, deposited crystals of alum, which, washed with a little cold water, and dried in the air, weighed 0·04, being equivalent to about 0·006 gram of hydrochlorate of potash.

On changing the magnesia and the oxide of iron into hydrochlorates, the mother water of Guaca was found to be composed of—

	Mother water.	Sea water.
Water	0.7064	0·9691
Hydroclorate of soda	0·1527	0·0218
Hydrochlorate of magnesia	0·0450	0·0049
Hydrochlorate of lime	0·0930	0·0008
Hydrochlorate of potash	0·0002	a trace
Hydrochlorate of iron	0·0027	0·0000
Sulphate of soda	0·0000	0·0034
Hydriadate	traces	0·0000
Hydrochloric acid	a trace	0·0000
	1·0000	1·0000

In comparing the composition of the mother water of Guaca with that of sea water, it may be remarked that the first contains almost the same salts as the second, with this difference, that they exist in it in larger proportions. The proportions of the salts to each other are not the same in the two waters. In the first, the hydrochlorate of lime nearly equals the marine salt; but it is easy to conceive that if a large quantity of sea water were evaporated, and that a great part of the hydrochlorate of soda were separated from it by crystallization, a mother water would be obtained, which would much resemble that of Guaca. In operating on a certain mass of sea water, the hydrochlorate of potash might not only be appreciated, but it is also not unlikely that the iodine might be rendered sensible; for, although to the present time no one has succeeded in finding it in sea water, the existence in it of this substance is not the less admitted tacitly; otherwise we must suppose, that it is formed altogether in the marine plants, a supposition which would be contrary to all received ideas.

In evaporating a solution saturated with many salts of different solubility, it is evident that the most soluble are the last separated. In proceeding on this principle we may perceive, by the above analysis, that it would require about 116 litres of sea water to contain a proportion of hydrochlorate of lime equal to that in the mother water of Guaca.

I am far from wishing to explain the origin of the saline earths by the evaporation of the sea water: this is only a fact which I offer to those who, from considerations entirely geognostic, desire to investigate a similar explanation.

ACCOUNT OF NEW PATENTS.

Patent granted to THOMAS RICHARD GUPPY, *of Bristol, Gentleman, for improvements in masting vessels.* Dated November 4, 1824.

THE method of masting vessels directed in the specification of this patent, may be conceived by supposing a pair of spars, placed like shears, over one of the beams at the parts of the deck where the common masts are usually placed, meeting at top about the height customary for them, and spread asunder below the whole breadth of the deck. These spars, or small masts, which the patentee calls "*double pole masts,*" are to be placed over a beam of greater than ordinary strength, which also is secured by knees stronger than those commonly used. A strong iron shackle-joint secures the bottom of each spar to one of the extremities of the beam, the joint being so placed as to admit the spars to be inclined fore or aft, or to be lowered down on deck, if required; an iron strap ascends from the joint two feet or more up each spar, where it is secured by bolts, and by a broad band at each extremity; and strong iron straps descend from the same joint at each side of the beam, to which, and to the sides of the vessel, they are securely bolted. At the top the two spars are either halved together or spliced, and have a broad iron cap well fastened over the place of union, from the front of which a broad iron hoop projects to receive the top-mast, which passes down through it to a second hoop, also of iron, placed a few feet lower, that embraces the two spars at that distance from above; in which lower hoop it is supported by either a common fid, or by one of the lever construction. The cross tree is placed at the level of this lower hoop, and has nothing peculiar in its construction.

The preceding method is that applicable to fore-and-aft sail vessels, and the following is another mode of joining these shear-masts at top, which the patentee directs for square rigged vessels. In this method the two spars cross each other a few feet from the top, at which place they are to be halved together. A cross-piece, which forms part of the round top, is then laid over the tops of the two spars, coaked to them, and strongly fastened to them by iron straps and bolts; the upper support for the top-mast is fastened to the front of this cross-piece; and the lower one, where the fid is to be applied, is placed where the spars cross lower down, and is there united to a broad and strong hoop, that surrounds the point of junction of the masts, at each side of which hoop as many iron loops are fixed as will be required for the shrouds. The round top, in this second method, is to be placed on a level with the tops of the two spars, where the cross-piece above-mentioned lies, and is secured by two iron braces that pass down from it obliquely to the joining of the spars.

To fasten on the shrouds to the top of the spars, in the first mode of placing the latter, an iron strap passes over the common top of the spars, and descends at each side as low as the iron work that supports the heel of the top-mast, where it is formed into loops or rings, to which the upper ends of these shrouds are fastened.

The patentee thinks that the fore and aft stays will be alone necessary for double masts of this description, as the strain across ship is sufficiently provided for by their position; but at the same time states, that shrouds at the sides may be also used for further security, or for affording means of going aloft, and that their arrangement, and all other matters respecting the rigging, may be managed as the captain of the vessel may think best.

The mode of jointing the bottoms of the spars described, admits also of their being used as shears for raising goods from the hold of the vessel, by the addition of suitable tackle, as they can be inclined either forward or aft for this purpose, till their heads come over the hatchway, up which the goods are to be hoisted; which use of them the patentee seems to consider a matter of much importance.

In our remarks on Mr. Higgins' patent for rigging vessels, &c. inserted in our supplementary Number, vol. 1, p. 466, and which were sent to the press before we had seen Mr. Guppy's specification, we have in some sort anticipated our account of his invention, in a manner that sufficiently shews our good opinion of its valuable properties. And we shall now add that we think the plan peculiarly advantageous for all fore and aft rigged vessels, including all sorts of sloops, cutters, and schooners, from its admitting the use of sails that will have all the advantages of lug-sails, and of the sails used in the galleys in the Mediterranean, in their lifting action, and in every other respect, without being subject to any of their inconveniencies.

These double spar-masts, or shear-masts, will also be much less expensive than common masts, and this in a ratio increasing in proportion as the vessel is larger; and they will moreover allow of a diminution being made in the number and strength of the shrouds, as stated by the patentee, which will produce a further saving.

This latter effect, we are of opinion, would be much increased if two pair of spars were used for each mast, instead of one pair, placed so as to form the outlines of a pyramid, and fastened at top and bottom as the others are, which would probably produce so much strength in resisting strains across ship, that where they were used all shrouds whatsoever might be safely omitted; and of course all the cost of those very expensive articles be saved.

The application of these double spar-masts as shears for lifting goods, appears to us, at best, but a very secondary consideration, as shears are so easily formed of spare top-masts or yards; and, indeed, we should not think it worth while to derange the rigging to use them in this way; but the facility of lowering these masts which the joints afford might be very serviceable in storms, and would be peculiarly useful for steam-vessels.

Patent granted to Edward Lees, *of Little Thurrock, Essex, Publican, and to* George Harrison, *of the same place, Brick-maker, for a new and improved method of making bricks, tiles, and other articles manufactured with brick-earth.* Dated February 1, 1825.

In the machinery used in this method of making bricks, a cylindrical vessel, strongly hooped with iron, of the nature of a pug mill, has a vertical shaft made to revolve in its centre, from the upper half of which project four flat arms, at equal distances from each other both vertically and horizontally, having spikes projecting from them upwards, and being sloped so as to form inclined planes; by which means, the clay thrown in at top is divided, worked, and forced downwards, to be acted on in a similar manner by eight other flat cutters, somewhat curved, that project horizontally from the lower part of the same axle, at equal distances in both directions, like the steps of a circular staircase; these cutters being likewise sloped, besides working the earth, continue to press it downwards, till they force it out into two square cases, placed at opposite sides of the lower part of the cylindrical vessel. In these square cases loaded pistons move, which are made to rise up by the action of cam wheels, and fall down at the end of each of their revolutions on the clay, pressed into the cases as described, so as to force it by their weight in falling into the brick-moulds, placed beneath the cases on an endless chain, which brings the empty ones up successively to be filled, and at the same time draws those which have been filled from beneath the cases.

To separate the clay in the moulds from the rest, a long knife, turning on a pivot at one end, is made to pass over them horizontally, just as they are being moved away. This movement of the knife is effected by the action of a lever and sliding piece, worked by a crank in one of the axles of the general machinery. There is also a sliding partition fixed between each case and the cylindrical vessel, by which the aperture between them, for the passage of the clay, can be regulated so as to deliver more or less, as required.

The endless chains are composed of flat links, connected by pins or rivets, and from the links studs rise up, that enter into the moulds, and keep them in the necessary position; these chains pass over hexagonal rollers at each end of the space over which they traverse, every face of the rollers being as broad as each link of the chain is long; and on the same axis with one of them is a flat disk, from which project jointed catches in the lines of its radii, which yield to the motion of a sliding bar beneath, when moving in one direction, so as to fall into a groove or cavity in it; but on the sliding bar being retracted, are by it drawn on so as to turn round the disk, and with it the hexagonal roller, and thus draw forward the endless chain and the moulds, as mentioned. This alternately reversed motion of the sliding bar is caused by a crank on one of the shafts of the machinery, which revolves within an oval frame attached to the bar. The endless chains are supported just beneath the clay cases by two common rollers, which sustain the moulds above them, when the clay is being forced into them.

The cam wheels that raise the pistons in the clay cases, the cranks that give motion to the endless chains, and those which move the knives for cutting the clay over the filled moulds, are all connected by shafts and wheels and pinions with the main vertical axle in the cylindrical vessel, in such a manner that when it is forced round they all have their due motion regulated, both as to time and degree, as is most suitable for the operations which each part is intended to perform.

There being two clay cases to the cylinder, it is to be understood that all the other parts of the apparatus are to be double also; and, in fact, in the draft two endless chains are represented beneath each clay case, so that four moulds will be filled altogether at once by the machine.

The particulars of the machine are described as for making bricks; but the patentees state that it can be easily adjusted so as to make tiles; or other similar articles, by alterations which do not require particular explanation.

The vertical shaft of the cylindrical vessel, and the machinery connected with it, as described, may be turned by a horse, or any other power which may be most convenient.

The machinery of this apparatus seems well designed for effecting the several movements required; but the contrivance for driving the clay into the moulds appear to be defective, as, from the tenacious nature of the clay, the pistons would probably be too much impeded in their motion in the cases by what would adhere to them, to permit them to fall with due efficacy on the portion passing into the moulds; and besides this, it does not seem likely that the machinery described could long endure the concussions of the violent hammering and driving of the pistons, without receiving great injury.

Several patents have been lately obtained for engines of this nature, which shows that the attention of the ingenious is directed to the improvement of brick-making; and we may therefore hope that some of them will endeavour to improve the qualities of the bricks themselves, as well as to make them more expeditiously, and provide good materials for their composition, as ingenious machinery for their formation.

Patent granted to Rodolph Cabanal, *of Melina-place, Westminster-road, Lambeth, Engineer, for improvements in engines or machinery for raising water, part of which machinery is applicable to other purposes.* Dated March 30, 1825.

An idea may be formed of the apparatus for raising water, which is the object of this patent, by supposing two segments of large circles placed parallel to each other, on a level plane, at a small distance asunder, and connected together by frame-work. These segments, on being depressed at one end, would rise at the other, and would maintain the motion so acquired for some time, on the same principles by which the oscillations of the pendulum are performed, and which have been applied in this very manner to the common rocking horses for children, as well as to their cradles.

From these segments a frame-work ascends, which supports troughs that rise up obliquely from side to side, the lowest having one end a little below one extremity of the segments, and connected at its other end with the lower extremity of the next trough, which is in like manner joined to that above it, and so on in succession, according to the number of troughs used; the ends of the troughs open sideways into each other, and the lower end of the lowest has valves in its bottom for the admission of the water, which may be conveyed to it by a small canal passing between and beneath the curved segments. In this apparatus, when the end of the lowest trough is dipped into the water, a portion of it enters into it through the valves; the rocking segments being then depressed at the other end until the lowest trough slopes in the other direction, the water will run down at that side, and part of it will go into the end of the second trough, which, at the next oscillation, will pass from it in like manner into the third, and from that, at the third oscillation, into the fourth trough, and so on through the other troughs, till it is delivered out at the top into the spout or pipe which is to convey it where wanted.

The only other addition directed for the troughs is a sloping board, placed above each of their ends, to prevent the water from being dashed out over them by the motion of the apparatus; by which we may infer also, that the troughs were intended to be open at top.

We have seen a description of an engine for raising water by a similar succession of troughs, on an oscillating principle like this invention of Mr. Cabanal (to the best of our recollection, in the collection published by the French Academy); but having had a drawing of it lying by us for many years, we cannot be mistaken as to the fact. We think also that we have seen a similar machine described in Leopold's collection.

The machine, however, first-mentioned, was hung on a pivot or axle, at the top of a high frame, so that its oscillations were more precisely performed in the manner of those of a pendulum, instead of being effected by rocking, as those of the machine described; and the lower end of each of its troughs, above the first, descended a little below the top of that next beneath it, by which the water was prevented from running back again in the same trough through which it had passed in a former oscillation.

The same effect would be still better produced by valves placed in close troughs or tubes, which would have the additional advantage of causing the momentum of the water to assist in making it to ascend at each oscillation; and which would be effected still better if the tubes were curved round at each turn, instead of joining each other at acute angles, as represented in all the drawings of machines of this kind which we have seen.

In machines of this nature, each of the upper troughs must be made shorter than that beneath it as they ascend; those which swing on a pivot would not act at all if not made in this manner, and those on the rocking construction would be top heavy, and would tumble over at the first oscillation, if this precaution were neglected.

The swinging machine seems likely to move with less resistance than the rocking machine, and in other respects to deserve the preference. But in both machines the weight of the water to be lifted in each oscillation would, it appears to us, be much more in proportion to that delivered at the top than in a common pump, while the expense of the apparatus would be vastly greater; and this is probably the reason that this method of raising water never came into common use, though the first machine was publicly known in the time of Louis XIV.

Patent granted to Thomas Parkin, *of Baches-row, City-road, Middlesex, Merchant, for a mode of paving parts of public roads in a certain manner, whereby the draft of waggons, carts, coaches, and other carriages, is facilitated.* Dated March 29, 1825.

The method of paving *parts* of roads, for which this patent has been granted, consists in forming two parallel rows or lines, of hard materials, at a proper distance asunder to support the wheels of loaded carriages, which distance must be regulated by the medium length of their axles, thus forming a track or way for them, similar to a rail-road.

Five varieties of this method are described by the patentee; the four first relating to stone rail-ways, and the fifth to a compound rail-way of stone and iron.

In all the methods of making the stone-ways, long blocks of granite, of a suitable breadth and depth, which latter is not particularized (but probably need not exceed a foot either way), are laid level in the manner mentioned, and when the ground is soft must have sleepers of stone or other fit material placed beneath their joints; but when the ground is hard enough, the modes of jointing these stones (in which the differences of the four first varieties consist), will support them in their places sufficiently without any sleepers.

In the first mode of jointing the stone blocks, one end of each block is to be cut so as to form a projecting angle of equal sides, and the other end so as to form a re-entering or hollow angle of the same dimensions, in the mode called the "bird's mouth" joint by stone cutters.

In the second method a cavity, of a square or cylindrical form, is cut in the middle of the ends of each stone, and a piece of iron formed to fit it; which being lodged in its place, when the stones are laid together, will keep them from moving singly in any direction from the line in which they are fixed. The patentee prefers cylindrical cavities and plugs, on account of the greater facility of their formation.

In the third method a horizontal groove is cut across in the middle of the ends of each stone, and a corresponding piece of iron or hard stone is prepared for it, which will, when in its place, cause the stones to support one another at their extremities.

In the fourth method two grooves are to be cut at the ends of each stone, crossing each other at right angles in the middle; and crosses of cast-iron are to be made of suitable dimensions for them, which, placed in a similar manner to the other pieces, will equally prevent the stones from motion.

The fifth variety is composed of pieces of cast-iron, about 30 feet in length, of the same breadth as the stones mentioned, and of a suitable thickness, which iron pieces are to be laid on blocks of stone, placed in parallel rows like the others; and screw bolts are to be passed through the iron plates and stones, at proper distances, the heads of the screw bolts being countersunk in the plates, and their other ends drawn tight by nuts pressing against the undersides of the blocks, which in this mode may be made of a softer and cheaper sort of stone.

Methods of making stone rail-ways, very similar to those of the patentee, have been described by Mr. H. Matthews, in the second Report of the Committee of the House of Commons on the Acts relating to broad-wheels, roads, &c. printed in 1806, and reprinted in 1808. We also find that a mode of paving, similar to that first described in the specification of this patent, has been used for a long period in Florence, and some other cities in Italy.

Patent granted to HENRY JAMES, *of Coburg Place, Winson Green, near Birmingham, Engineer, for improvements in apparatus for diving under water, which apparatus, or parts of which apparatus, are applicable to other purposes.* Dated May 31, 1825.

THE diving apparatus of Mr. James consists of two parts, the dress for the diver, and a vessel for holding condensed air, constructed so as to surround his body from the breast to the hips. The dress consists of a "helmet" of copper, or of sole leather coated with varnish; or, according to the drawing, his head, shoulders, and great part of his breast, are enclosed in a case formed of one of these materials. Opposite the eyes in this case a strong piece of glass is fixed, for the diver to look through, and to its lower part is fastened what may be called the pantaloons of the diver, reaching to his ancles, made of leather and rendered waterproof, while a pair of sleeves of the same material protrude from its shoulders, and extend to his wrists. This dress is fastened round the limbs and body by various straps or belts; one on each ancle and wrist, one on the upper part of each thigh, one on the upper part of each arm, and one round the body, just above the hips.

There is a variance between the text of the specification and the drawing as to this dress, which, however, is not very material, but in this description of it we chiefly follow the latter.

"The air vessel is composed of two hollow cylinders of metal, placed one within the other, and of such sizes as to leave a space between them four or five inches across, the capacity of the inner one being sufficient to admit the body of the diver, and their depth about what would extend from a little beneath his arms to near his hip joints. These two cylinders are joined together by four or more horizontal partitions, at equal distances from each other, which in front are united to as many pair of flanches that project from the front cylinder, the intention of which is to render the whole vessel very strong, and every external part of it is of course made air tight.

This air vessel is slipped on the body of the diver from below, and is then fastened by straps over his shoulders; from its upper part a tube of caoutchouc ascends to the front of the helmet, a little below the mouth of the diver, where it is united to the helmet by a union joint; and where it issues from the vessel it is furnished with a cock, by which the diver may supply himself with air as he chooses; on the top of the helmet is a short tube, with a valve opening outwards, and pressed down by a spring; from this short tube a pipe descends within the helmet to a level with the mouth of the diver, where a flexible tube joins it, furnished with a mouth-piece of bone or ivory for his use. The air vessel is to be filled with air, compressed by an air pump to a degree equal to thirty times the pressure of the atmosphere, or is to contain what is called "thirty atmospheres," which the patentee calculates will be sufficient for the supply of the diver for one hour; and for the admission of this air it has a short screwed tube fastened to its upper part, by which it may be connected with the air pump by pipes with union joints. A spring valve or a cock being then fixed to the upper part of the breast of the copper case, by which the diver can let out some of the air if he finds it too much compressed, and some weights or bags of shot being suspended from the bottom of the air vessel, to overcome its buoyancy, the whole of the apparatus will be completed; and the diver has then only to get into it, buckle on his air vessel, brace his belts and straps tight, take his air pipe in his mouth, and, descending into the water, proceed to action, not forgetting to take with him a pole-axe, with which the figure in the drawing is armed, we suppose for defence against sharks, or other monsters of the deep, that might chance to come to peep at his submarine costume somewhat nearer than might be agreeable.

The patentee states, in concluding his specification, that the apparatus described may also be used for descending into mines, or other places, where the air is too impure to be breathed with safety.

We should have hoped for something better from the ingenuity which the patentee has evinced in some of his other productions than this very imperfect apparatus, and even this combined from different sources, some of them of very old standing.

In the 20th plate of the second volume of Dr. Desaguilier's Lectures on Natural Philosophy, published in 1763, may be seen a good figure of the diving helmet, added to a little more armour of the same description; and as to the idea of supplying a diving apparatus with compressed air, Mr. Healy has long since anticipated the patentee, in actually putting this method in practice, as may be seen in the interesting account which he published respecting this ingenious and successful experiment in vol. xv. p. 9, of the Philosophical Magazine.

The idea of a diving dress, somewhat similar to this, is to be traced to still more remote periods than those mentioned, of which we shall only instance that described by Borelli, of which we have a copy published in 1685, in a print of which the diver is drawn as well equipped at least as any of the cetaceous fishes, for abiding beneath the water, ascending and descending in it at pleasure, not forgetting the grand desideratum of locomotion, in the very act of which he is represented making rapid progress apparently.

Two great difficulties subsist as to dresses of the kind described; first, how to make them water tight, and secondly, how to get into them afterwards, without destroying that essential quality. We can hardly think the patentee serious when he mentions belts round the body and limbs as being sufficient for keeping out the water, unless they were drawn so tight as to endanger stopping the circulation of the blood, and put the wearer to torture; nor will the compressed air be more easily confined by this dress, than the water be prevented from entering.

Among the other defects of this diving dress it should be noticed, that the glass in the front of the helmet would soon become opaque by the breath of the diver, when under water, and that if the mouth-piece fell from his lips he could not possibly replace it while there. The apparatus, however, might be found serviceable for entering mines (as mentioned), and houses also in incipient conflagration.

Patent granted to DAVID REDMUND, *of Agnes Circus, Old-street Road, Middlesex, Engineer, for improvements in building or constructing ships, houses, and other buildings.* Dated June 28, 1825.

THE method of building ships comprised by this patent, consists, principally, in shaping the timbers or ribs in a peculiar form, and uniting them close together, *sideways*, by screw bolts and nuts, so securely, that the vessel might be floated before being planked if it were desired.

The ribs, as regards their form sideways, are to be made tapering from the bottom upwards in the whole of the frames, from the fifth or sixth from midship both towards and at the head and stern of the vessel; the consequence of which formation, added to their being put close together, must be, that lying like the radii of a great circle, their inclination will increase more and more, as they are more remote from the midship; until the last timber at both ends will have its upper surface horizontal, or on a level with the upper deck. The shape of the timbers in the other direction, from the inside to the outside, or their moulding, is in the midship to be nearly the same as in other vessels; but from thence, in both directions, the frames (or sets of connected timbers across-ship) are only to be made less deep as they approach the extremities, while they preserve their other dimensions, till they rise above the parts sloped from the bottom upward, after which their form is to be that best suited to their respective positions; those at the bow being shaped according to the outline most usual for that part, and those at the stern being formed agreeably to the outline most approved for round-sterned vessels. This method will maintain the arched figure through all parts of the hull; from which the patentee expects such vast accession of strength, that in his opinion no storms can bilge or sink vessels thus constructed; and even if driven on shore, they will still remain unimpaired, bidding defiance to winds, waves, and rocks.

Vessels, in the state described, would externally present a very unusual shape; but the patentee, not intending that this should be the case, directs that both extremities of the vessel shall be brought to the usual forms for those parts, by the addition of *dead-wood*, as it is called, bolted or trenelled to the frames and to itself; the keel, keelson, stem post, and stern post, being first properly arranged, and bolted firmly to the other parts.

The individual pieces of the timbers are to be disposed so that their joinings may be reciprocally opposite the middle parts of the pieces, next adjoining at both sides, or so as to *break joints*, as it is called, and the screw bolts by which they are to be fastened together sideways being made with square threads and large nuts, and furnished with very broad washers at both ends, are each to be long enough to pass through two ribs sideways; and before each piece of the timbers is put in its place, as many bolts are to be driven through it as will be requisite for the part of the piece that is next to be placed beside it, more than one half of their length projecting out sideways, and proper cavities being previously made in the timber for the bolt heads and their washers. The piece being then screwed up tight, holes are to be bored in the next piece which is to be fastened beside it, corresponding to the projecting bolts just mentioned, and bolts for the ensuing piece being first put through this last piece, similarly to that preceding, it is then to be driven on upon the bolts projecting from the pieces last fastened up; washers being then put over the ends of these bolts, the nuts are to be screwed tightly on them, cavities being also made for the nuts and their washers in either the timber being fastened on, or in that which is to be next fastened beside it, according to the length of the bolts; the heels of the timbers are to be mortised and secured together by iron keys, and the timbers themselves are to have grooves cut along their sides, exactly opposite to each other, in which soft cords are to be laid before they are finally screwed up, which will tend in themselves to keep out water, and will, besides, keep the calking from penetrating too far, which is to be driven in between the timbers before the planks are put on; which planks are to be fastened on in the usual manner, being however made much thinner than customary, as the patentee asserts that the great strength given by the mode of fastening the timbers described, will make any addition of strength from the planks quite superfluous. The decks are to be constructed in the same manner as the sides of the vessel, by pieces of timber screwed together sideways, reaching across-ship in the direction usual for the beams; and square pieces of larger scantling are to be bolted fore and aft to the sides of the vessel, from head to stern, close beneath where the extremities of the deck timbers are to extend to support them.

These deck timbers, not requiring to be more than seven or eight inches thick, will occupy much less space between decks than the beams, carlins, and ledges of the present deck frames, and are to be tied to the sides of the vessel by iron fastenings, reaching quite across from side to side, at intervals from each other of about five or six feet. Each of these iron ties is to be formed of two pieces, connected together in the middle by dove-tailed joints, and are to have strong screws cut at their extremities, which, passing through the sides of the vessel, are to be drawn tight by strong nuts, laid over washers. The deck timbers are also to be stiffened by iron trusses, placed at about the same distance asunder as the ties, which are to consist each of two pieces of square bolt iron, passing obliquely upwards from the lower sides of the two ends of the timber next them to the upper edge of its middle, and are secured by iron keys, driven into the deck timbers at the places mentioned, from giving way or starting from their places. The deck being thus prepared, strengthened, and fastened to the sides of the vessel, is to be afterwards covered with thin boards, running in the usual direction, and nailed or pegged down upon it.

The method described for forming the two extremities of the vessel is far the best, in the opinion of the patentee; but he states that in those parts the timbers may be also made of their usual shape, from inside to outside, or across-ship, and only be shaped sideways as before directed, narrower at the upper ends than at the floor timbers, which would not require so much dead wood as the other method; but these would not have the advantage of the arched form of timbers in those parts, which he supposes would have the wonderful effects already recited. All other parts of the vessel, not particularly mentioned, are to be made in the manner most approved by experienced shipbuilders.

The method of building houses, directed by the patentee, is an application of the part of that used in his plan for building ships, in which tapering timbers are used, narrower at top than at bottom; the front, back, and sides of the house are to be constructed of straight timbers, sloped in this manner, proper apertures being left in them for the windows and doors. This mode of building will give the house the form of an obtruncated pyramid, which will be best to preserve it from the action of the wind, houses of this kind being designed by the patentee for such parts of the West India Islands, and other places, as are subject to hurricanes.

These houses are to have but three stories, two above ground, and one under ground, or a cellar story; and to secure them still further, piles are to be driven into the cellar floor, beneath the four corners and other parts of the foundation of the timber walls, to which these are to be firmly bolted, the earth also being filled in close to the sloped sides of the cellar story, and rammed tight, will increase the stability.

The floors of the house are to be formed as the decks of the ship described, of straight pieces of timber, running quite across the house, and are to be supported at each end by square timber of larger size, laid horizontally, and bolted to the sides of the house, and the ends of the floor timbers are then to be bolted down on them. All the timbers of the walls of the house and of the floors are to be laid close together, and to be fastened to each other sideways by screws and nuts, in the same way as the timbers of the ship before-mentioned.

The roof is to be made as the floors, differing only from them in having a fall of about 9 inches across the house, to throw off the rain. This roof is to be covered with lead, which is to lap over the sides a little way, where it is to be well nailed, and a light railing is to be made round it, which if blown away by the wind can be easily replaced. The seams or interstices between the timbers of the house are to be well caulked at both surfaces, and the whole is then to be well done over outside with Parker's cement, or some other water-proof cement of equal durability. The rest of the house inside is to be formed as shall seem best to the builder; the square pieces that support the rafters or timbers of the floors may be moulded to look like cornices; and by wainscoting, or other methods, the sides of the rooms may be made perpendicular, as represented in the drawing of the specification, to take off the awkward effect which the inclination inwards of the timber walls of the house would occasion.

The patentee commences his specification with remarks on the weakness of the common method of constructing ships, in which we for the most part entirely coincide with him, except as to what he says relative to trennels and to planking; the power which the trennels produce by their position and by their numbers not seeming to be known to him, or that which the planks give to be duly appreciated.

The greatest strains which a ship experiences on the sea, are when in high waves the stern or head is left unsupported, or but inadequately so, by the water; and so far from this being provided for by those who direct the building of large ships, which are most exposed to it, they overload these parts with upper works and guns, the weight of which tend continually to tear the vessel asunder in the middle, so that there is not a single vessel thus built whose extremities do not dip down considerably below the line on which they were constructed, or become what the sailors call *hogged*, from their floors rising up in the middle like the back of a hog. This matter being duly considered, it will be evident that a ship requires strength principally lengthways, or fore and aft, and that it is on the support of the planks that it entirely depends for this strength. For this reason, any plan which proposes the diminution of the planks, without providing other means of giving support fore and aft, must be evidently erroneous; and that of the patentee seems to us to be precisely in this predicament, the screws affording no due support in this direction; and the strain upon them being lengthways; and bolt iron being known to yield or become wire drawn by such strains, they must tend to become loose by the working of the ship in stormy weather, so that it appears to us that this method of ship building would be really weaker than that in common use, instead of having the prodigious strength which the patentee supposes. Furthermore, if a timber becomes decayed, a very common occurrence at present, what is to become of a vessel built on this plan? Each timber being fastened to two others *only*, the whole connexion is thus like that of a chain, in which the failure of a single link destroys the support; so that if a single timber fails, the link-like connexion must be at once interrupted, and nothing in the construction of the vessel remaining to supply its place (the planks being avowedly and designedly too slightly for the purpose), we own we can conceive no reason why a vessel in this state should not part asunder at the line of the decayed timber, in the first storm which it might encounter.

Considering also the great number of screw bolts that would be required for this plan, their expensive construction with square threads, the large quantity of other expensive iron work which would be required for it, and the amount of extra labour which would be necessary for fixing it and the bolts in their places, this mode of ship building seems to us to be one of the most costly we ever heard proposed, without producing any one benefit in return that is in the smallest degree apparent.

The plan for building houses for countries liable to hurricanes, seems to us well calculated for resisting the force of the wind; but it appears that the same might be effected by framing of a less costly species, and which would not require so much solid timber, or such a prodigious number of screw bolts of the expensive description directed in the specification. It is not probable that Parker's cement, or any composition of the mortar species, would adhere long to the surface of wooden houses, particularly in the tropical climates where hurricanes prevail, and for which the houses of the patentee are designed; since in those countries the contraction of the wood from heat, and its expansion from moisture, must be very great; the fall of rain being there frequently vastly beyond any thing ever witnessed in our part of the globe, and the heat excessive. The alternations therefore of these changes in the dimensions of the wood could hardly fail of cracking, and causing to fall off from it, any hard cement of the description mentioned by the patentee.

Patent granted to ROBERT WILLIAM BRANDLING, *of Low Gosforth, near Newcastle-upon-Tyne, Esq. for certain improvements in the construction of rail-roads, and in the construction of carriages to be employed thereon and elsewhere.* Dated April 12, 1825.

THESE improvements consist in methods of preparing the wheels of carriages so as to serve either for common roads or for rail-roads; and in making additions to the latter, to facilitate the passage of the wheels either in ascending on them from the common road, or in coming down from them again. These additions, which are called elevators by the patentee, are inclined planes or slopes, of about the same breadth as the rail, in an angle not defined, but represented in the drawing seemingly between 20 and

30 degrees, and placed parallel to the rail-roads. At one side of these elevators are pieces called guides, to which additional pieces are connected by joints, so as to open out or lie parallel to the rail-road, the use of which the patentee states to be "to form a passage across the common road;" but this we imagine to be an error, as they seem better calculated to form a passage across the rail-road for carriages going on the common road.

The improvements in the construction of carriages consist, first, in forming the rims and tires of the wheels so that they can be used either on rail-roads or common roads; one mode of doing which is by forming the rim with a projection at each side of its face, and a hollow of course in the middle, which latter is intended to run on the rail-road, while the projecting rims serve only as guides; but on a common road these latter, on the contrary, sustain the burden, while the hollow part remains unemployed. In another construction of wheels described, one half of the rim rises an inch or inch and half above the other half on the surface, and when used on a rail-road the former serves as a guide or flanch, to prevent the wheel from rolling off; but when on a common road, alone sustains the carriage.

A second *improvement* is called a "scraper spring and joint," of which the spring and joint are not described; but from the drawing we learn, that the scraper is formed by an upright bar, ascending from the axle, from which a piece projects at right angles close over the top of the wheel, which latter, from its position, will free the wheel from all dirt above the level of its lower edge.

The third and last improvement is a mode of fastening shafts to the carriages, which is nothing more than a flat bar that projects from the carriage about a foot, at the place proper for putting on each shaft, and which enters into a groove or mortice cut through the end of the latter for its reception, where it is secured by two vertical bolts, of which that which is next the carriage is called the fixed bolt, and the other the moveable bolt. When the latter is taken out, the shafts can be placed in a position oblique to the cart, the use of which the patentee has not explained; and when both bolts are removed, the shafts can be changed to the other end of the carriage, where projecting bars are to be placed for them, similar to those described; by which arrangement the carriage may be moved in a direction opposite to its former course, without being turned round, which, when it is used on a rail-road, may be a considerable convenience.

There is nothing in this specification that appears to us of a novel character, unless we thus denominate the mode of shifting the shaft, which, however, has little to deserve commendation. The scraper for wheels is in common use in France, but is there placed on a level with the axle behind the wheel, which is a much better position than that exhibited in the drawing by the patentee, in which, from being placed on the top of the wheel, it must throw the dirt down on the nave at both sides, whence some of it can hardly fail to find its way to the axle, and interior of the box that surrounds it, and thereby increase the friction, and cause it to wear out much more rapidly.

REVIEW.

Mathematics for Practical Men, &c. &c. By Olinthus Gregory, LL.D. 8vo. p. 411.

This work consists of a collection of treatises on arithmetic, algebra, geometry, trigonometry, conic sections, curves useful to architects, isometric perspective, mensuration, mechanics, statics, dynamics, hydrostatics, hydrodynamics, pneumatics, and on active and passive strength, and concludes with a few supplementary tables, relative to the circle and catenary curve.

The design of the publication, as we are given to understand by the author's preface, is to give information to the younger members of the institution of civil engineers, and to the other youths who are designed for that profession; and also more particularly "to contribute to the instruction of that numerous class, the practical mechanics of this country," who, "unable to go through the details of an extensive systematic course, must for the most part be satisfied with imperfect views of theories and principles, and take much upon trust;" and a quotation is made from Mr. Brougham's pamphlet on the Education of the People, asserting, among other matters, that "an essential service will be rendered to the cause of knowledge by treatises on Natural Philosophy, &c. &c. which may teach the great principles of physics, and their practical application, to readers who have but a general knowledge of mathematics, or who are even wholly ignorant of the science beyond the common rules of arithmetic." This quotation led us to suppose that we should find the work sufficiently intelligible to men in this situation; but the end of the same page which contained it, showed us that this was not to be expected, as we are there given to understand, that a competent knowledge of algebra is also necessary for its perusal, which science and arithmetic "being possessed as valuable prerequisites," (the passage states that) "the course of an author will be facilitated; for then, while he endeavours to express even common matters so that *the learned may not be disgusted*, he may so express the more abstract and difficult that the comparatively ignorant (and the mere knowledge of algebra and arithmetic is in our times comparative ignorance) may practically understand and apply them."

From this latter part of the preface it is plain, that to produce a scientific performance, suited to learned readers, was a primary object with the author, and that he formed a very exaggerated and mistaken idea of the state of learning of *our times*.

A work designed for such various purposes,—to teach young men intended for a very scientific profession,—to instruct working men, pressed for time and unfurnished with previous education,—and to be palatable to learned readers, must indeed have been a literary phenomenon, had it fulfilled such difficult conditions, so opposite in their purposes, and in some respects incompatible; and that it should not have succeeded in doing so can therefore cause no surprise.

That the latter condition is performed we do not dispute. The work will not disgust the learned, but then the learned will not read it, not having need of instruction; and merely to show the world that the author is learned did not require this publication.

For the purpose of giving adequate information to those who intend to become civil engineers, even on the subjects of which it treats, few who are qualified to judge will for a moment suppose that any work of about 400 pages can be at all competent, much less this publication, which in that small compass treats of the numerous branches of learning above detailed. The work which approaches nearest this object is that of Dr. Young, on Natural Philosophy and the Mechanical Arts, which contains those valuable catalogues of works, on all subjects useful to the accomplished engineer, which, to those of that profession, will long form a treasure that only requires to be known to have its worth adequately appreciated; but the arts have received many useful accessions in the nineteen years since that excellent work was first published, and a supplement to it by its learned author is now most desirable; the want of which is very inadequately supplied by any publications we have yet seen on such subjects. The young engineer, who wishes to attain eminence, will, however, never take any book as a sole instructor; and though some of extraordinary genius have arrived at considerable rank, who had little assistance of any kind, yet nothing being more evident than that the self-taught individual must have, at first, an ignorant teacher, he will, on the contrary, seek the assistance of the best masters which he can find, endeavour to get actual suitable employment on the works of art, the construction of which he designs to make his profession; and will lose no opportunity of visiting and carefully examining the most eminent performances of that nature to which he can have access; and of studying, and taking notes from, the best publications relative to them which he can purchase or find in all libraries where he can obtain admission. We think no eminent engineer will say we have mentioned one superfluous point in what ought to constitute the studies of a young man that proposes to embrace that most useful profession; and this being granted, we need say nothing more of the total inadequacy of *Mathematics for Practical Men*, for giving young engineers even a proper insight into the sciences necessary for them, much less of making them sufficiently masters of them for their practical application.

We have now to consider the fitness of this publication for the instruction of practical mechanics, which forms the other and the chief object for which it is professedly designed; and on this point we must decidedly differ in opinion from the author.

To explain any thing to a person who is ignorant of it, we should evidently ground our explanation on something with which the learner is acquainted; and it follows of course, when we would instruct a number of persons in this situation, that we ought to make our explanations as simple as possible, and found them on what is at least very generally known; which was the object that Mr. Brougham had in view, when he recommended that treatises on Natural Philosophy, &c. should be prepared for the use of those who only were acquainted with common arithmetic; yet in the face of this excellent precept of the learned barrister, quoted in his own preface, has the author of this publication prepared a work professedly for the instruction of men in the predicament just mentioned, which, with the exception of a few pages on practical geometry, must be unintelligible to those who are not proficients in algebra; which is used throughout in the proofs of all the other sciences, and is even adopted in some of the explanations of the rules of arithmetic, thus raising up a formidable impediment where he professed to facilitate, and shutting the gates of knowledge in the face of the numerous class whom he had invited to enter its precincts. This incongruity cannot be solved by the assertion in the preface, that "algebra in our times is comparative ignorance," (meaning that it at present is so universally known by all classes that it may be thought so); but this is certainly by no means the case; so far from it, that of the class of working men, for whom this publication is professed to be intended, we may safely assert not one in a thousand knows any thing of it but its name; and even many others, who from their knowledge of the other sciences, and of ancient and modern languages, are well entitled to be called learned, hold algebra in but little esteem, from its great fatigue to the attention, and load to the memory, which renders it so much more liable to error than the other modes of investigation, and therefore have as little to do with it as possible; consequently, this seasoning of algebra, with which the author has so liberally supplied his book, to make it palatable to the learned, as professed in the preface, will not be, we apprehend, so generally acceptable to that body as he supposed; and even of the learned men who practise algebra, we have no doubt there are many who would have felt no *disgust* whatsoever at a book intended for the instruction of the uninformed, prepared according to Mr. Brougham's advice, on a foundation of arithmetic solely, and therefore unincumbered with algebra.

As it may be very discouraging to many artists who may wish to acquire useful knowledge, to have it held out to them that they must study algebra before they can even enter the porch of science, we beg of them not to be in any way disheartened on this account, for we can assure them that they can acquire a very competent knowledge of all the other sciences and scientific subjects, enumerated at the head of this paper, besides several others, without troubling themselves in any respect with algebra; and therefore so far from delaying their studies, in order to learn it before they proceed further, we should recommend them not to hesitate, but at once to bestow that time which is so precious to them, on the sciences more immediately beneficial to their interests; and in corroboration of this recommendation, let them only recollect the stupendous works executed by Brindley, in the Manchester canal; the wonderful machinery contrived by Arkwright, and its prodigious effects on the trade of this kingdom; and the very curious and beautiful engines and mill work for making lace, more recently invented and brought into such extensive use by Mr. Heathcoat, all without the smallest assistance from algebra; and we imagine they will not hesitate to think it not quite so indispensable to them as the learned professor supposes.

If they wish further to appreciate more exactly the comparative value of this science, they will find the subject treated in a learned and convincing manner by Dr. Young, in the second volume of his Natural Philosophy, pp. 555, 556; and in an excellent paper in the London Magazine for December last, by a Cambridge scholar.

We have further to observe of the work, that many of the rules contained in it are given in a very obscure manner, which in the arithmetical part often causes the rule to be more easily known by analyzing the example, than from studying its own meaning; which would make it necessary for a learner to have the assistance of a master throughout, instead of teaching himself from it, as might be expected from the preface. Books applicable to this latter purpose we conceive would be now highly useful, and as they are rare, think it may be of advantage to many who are eager for instruction, and cannot attend masters, to know that they will find a very excellent one of this description in the octavo edition of Gough's Arithmetic, printed in Dublin in 1787. It would have been a great improvement to the chapter on Algebra, to have explained some of the more complicated combinations in use of its symbols or characters; we are sure no learner could, from the account given of the simple characters, understand the combinations to be found of them in pp. 224 and 297, which are by no means the most complicated that are to be found in the book. The observations we have made in our review of Nicholson's Operative Mechanic (vol. i. p. 366), relative to combining, in one work, a number of treatises on various sciences, for the use of those to whom it may be an object not to purchase more than one of them at a time, will also apply to the present publication; but as single treatises of this kind are now in preparation, and some already on sale, we shall say no more on the subject, but to hope that these may be made sufficiently simple for the uneducated to instruct themselves by them, and that their authors will hold in remembrance Mr. Brougham's advice in this respect, instead of writing for learned readers, and the exhibition of their own talents.

We do not mean to say that the author intentionally wrote a work which the class of readers for whom it was expressly compiled could not understand. The great facility which long habit gives in the exercise of any art, would very naturally make him think algebra one of the simplest affairs in the world, and one which could occasion no difficulty to a learner of any common abilities. In like manner a music master might think the symbols of his art a matter of the most easy acquirement. Could we, however, see a master of algebra and a master of music meet for the first time for mutual instruction, though each of prime abilities in his own line, we can easily conceive what surprise each would feel at the slowness of comprehension of the other. The fact is, that the instructions of the most eminent professors in any science are very rarely simple enough for unprepared learners, since, from their totally forgetting their own past difficulties, they can seldom lower themselves sufficiently to the comprehension of their scholars to be good teachers; and this may account for the great success of the method of instruction introduced by Dr. Bell and Mr. Lancaster, where each boy is taught by another a little more instructed than himself, but fully holding in mind the mode in which he himself learned; which system proceeding upward by regular gradation to the head master, he may have his mind engaged in the most intricate labyrinths of algebra, or abstruse problems of geometry, without impeding the course of knowledge to the ignorant; while every class below him approaches each day, in a beautiful order, nearer the eminence on which he is situated.

After pointing out the unfitness of this publication as a book to assist self-instruction, we think it but fair to mention that we have little doubt that it will prove extremely useful to engineers of all descriptions, and to architects, as a pocket companion on their journeys, and a book of reference to consult and refresh their memories in the absence from more extensive works, which the duties of their professions frequently oblige them to experience.

LIST OF NEW PATENTS.

Robert Rigg, of Bowstead Hill, Cumberland, Gent. for a new condensing apparatus to be used with or applied to the apparatus now in use for making vinegar.—Dated February 4, 1826.—(*Six months to enrol specification.*)

Josias Christopher Gamble, of Dublin, chemist, for an apparatus for the concentration and crystallization of aluminous and other saline and crystallizable solutions, part of which apparatus may be applied to the general purposes of evaporation, distillation, inspissation, and desiccation, and especially to the generation of steam.—Dated February 7, 1826.—(*Four months.*)

William Mayhew, of Union-street, Southwark, and **William White**, of Cheapside, London, hat manufacturers, for an improvement in the manufacture of hats.—Dated February 7, 1826.—(*Six months.*)

Hugh Evans, harbour master of the port of Holyhead, North Wales, for a method or methods of rendering ships and other vessels, whether sailing or propelled by steam, more safe in cases of danger by leakage, bilging, or letting in water, than as at present constructed.—Dated Feb. 7, 1826.—(*Two months.*)

William Chapman, of Newcastle-upon-Tyne, civil engineer, for improved machinery for loading or unloading of ships, vessels, or craft.—Dated February 7, 1826.—(*Two months.*)

Benjamin Cook, of Birmingham, brass-founder, for improvements in making files of various descriptions.—Dated February 7, 1826.—(*Six months.*)

William Warren, of Crown-street, Finsbury-square, Gentleman, for improvements in the process of extracting from the peruvian bark, medicinal substances or properties, known by the name of quinine and cinctronine, and preparing the various salts to which these substances may serve as a basis. Communicated by a foreigner.—Dated February 11, 1826.—(*Six months.*)

John Lane Higgins, of Oxford-street, London, Esq. for improvements in the construction of the masts, yards, sails, rigging of ships, and smaller vessels, and in the tackle used for working or navigating the same.—Dated February 11, 1826.—(*Six months.*)

Benjamin Newmarch, of Cheltenham, Gent. and **Charles Bonner**, of Gloucester, brazier, for a mechanical invention to be applied for the purpose of suspending and securing windows, gates, doors, shutters, blinds, and other apparatus.—Dated Feb. 18, 1826.—(*Six months.*)

Thomas Walter, of Luton, Bedfordshire, straw-hat manufacturer, for improvements in the manufacture of straw plat, for the purpose of making bonnets, hats, and other articles.—Dated February 18, 1826.—(*Six months.*)

Charles Whitlaw, of Bayswater Terrace, Paddington, medical botanist, for an improvement or improvements in administering medicines by the agency of steam or vapour.—Dated February 18, 1826.—(*Six months.*)

Arnold Buffum, late of Massachusetts, America, now residing in Bridge-street, London, hat manufacturer, for improvements in the process of making or manufacturing and dyeing hats. Communicated partly by certain foreigners.—Dated Feb. 18, 1826.—(*Six months.*)

THE

REPERTORY

OF

PATENT INVENTIONS, &c.

No. X. APRIL, 1826.

Specification of the Patent granted to John Gunby, *of New Kent Road, in the county of Surrey, Sword and Gun Manufacturer, for a process by which a certain material is prepared, and rendered a suitable substitute for leather.* Dated February 28, 1824.

TO all to whom these presents shall come, &c. &c. *Now know ye,* that in compliance with the said proviso, I, the said John Gunby, do hereby declare that the nature of my said invention, and the manner in which the same is to be performed, are particularly described and ascertained in the following description thereof (that is to say);—I take woollen or linen cloth, of any requisite thickness, or a mixture of linen and woollen, or linen, cotton, and woollen, or felt, &c. as all these fabrics are convenient for my purposes. For such articles as require a pliable quality for the manufacture of ties for women's pattens, &c. I make a composition as follows;—Common glue size, in a state of jelly, about one part; fat boiled linseed oil, about four parts; lamp black, about half a part; white lead, as ground in the mill, about one part; pipe-clay, ground fine, about one part; litherige, ground fine, two parts. When the glue size is sufficiently melted at a moderate heat, add the boiled linseed oil by degrees, keeping the mixture in constant motion, until completely blended, and which will be effected in a few minutes. Then add the lamp black, white lead, and pipe-clay, and litherige, and when all are melted, and quite free from lumps, let the whole simmer for half an hour or more, by which means the composition will become much thicker, and consequently much firmer for the intended purpose; then the composition is ready to apply to the cloth. The readiest mode, I find, is to strain the cloth on a frame (or frames) of such dimensions as is most convenient; and with a proper size pallet knife (or any other convenient way) apply the composition (in a warm state) to the cloth, taking especial care the cloth is well filled with the said composition, so that when dried and cut it is found to be thoroughly saturated. When the cloth is so prepared, let the frames be placed where there is a circulation of air, or in a moderately warm room, according to the season of the year, as it is material the composition should be dried gradually. When the first coat of composition is found sufficiently dried, add a second, or third, or fourth coat, as may be thought requisite, taking care each additional coat is laid on as thin as possible (as a superabundance would prevent the desired pliability), leaving the surface every time as smooth as it can be made; and should such care not yield a surface so even as may be wished, let the cloth be cut into strips, of a proper breadth for patten ties, &c. and placed between iron or other plates, and passed through rolls, worked by a horse or mill, or manual power, by which means the surface may be made as even as the plates themselves. When I have proceeded thus far, I take oil or varnish colour, of any tint required; and when these coatings are dry, and the surface assumes a japanned appearance, the operation is complete, and the material ready to be cut up into patten ties, &c. such ties, &c. being finished in dies under a press or stamp, similar to raising impressions on paper, metal, or horn. For purposes which do not require to be so elastic, such as for carriage tops, &c. &c. I add glue, size, and pipe-clay, and white lead, in such proportions as the nature of the surface demands; and when the pieces are so large as to be inconvenient to pass through rolls, the surface may be rubbed down from time to time with pounded pumice stone, trippelo, &c. and then the oil or varnish colour applied as often as found necessary for the purpose intended.

In witness whereof, &c. &c.

Specification of the Patent granted to John Isaac Hawkins, *of Pentonville, Civil Engineer, and* Sampson Mordan, *of Union-street, City Road, Portable Pen Maker, for improvements on pencil-holders or port-crayons, and on pens, for the purpose of facilitating writing and drawing, by rendering the frequent cutting or mending the points or nibs unnecessary.* Dated December 20, 1822.

WITH AN ENGRAVING.

TO all to whom these presents shall come, &c. &c.: *Now know ye,* that in compliance with the said proviso, we, the said John Isaac Hawkins and Sampson Mordan, do hereby declare that our said invention of improvements on pencil-holders or port-crayons, and on pens, for the purpose of facilitating writing and drawing, by rendering the frequent cutting or mending the points or nibs unnecessary, is fully set forth and ascertained in the following description, illustrated by the drawings hereunto annexed, as explained by the references herein contained, that is to say;—Our invention of improvements on pencil-holders or port-crayons consists in the gradual protruding, by the means hereinafter described, of pencils or crayons from a tube, as they wear away by use, which means are shown by figs. 1, 2, 3, 4, and 5, of the said drawings.

Fig. 1, (Pl. IX.) A represents one of our pencil-holders or port-crayons, as seen in a state fit for use: B, longitudinal section through the axis of the holder and pencil together: C, D, E, F, G, H, I, and K, represent, respectively, the various parts of B separately. It is to be noted that the small letters refer, in all case, to the same articles in the different parts of the drawings; and that where a part is too minute to admit of a letter being put upon it, or so near it as to indicate clearly the place intended, a dot is made, and, in the nearest vacant place, two converging lines are drawn, pointing towards the dot; and the letter referring to the place of the dot is put between these converging lines. *a*, the pencil or crayon: *b*, a tube of gold, silver, or other metal, or metallic compound, into which the pencil or crayon is fitted so tightly as not to fall out by its own weight, but loose enough to be easily protruded at pleasure; this tube we denominate the nozzle. On one end of the nozzle is a male screw, and two milled rims, to enable the nozzle to be held firmly between the finger and thumb, in order to screw it tightly into its place: *c*, a tube, a little longer than the nozzle, which may be called the nut piece, having a female screw at one end to receive the male screw of the nozzle, and another female screw or nut at the other end, to receive the screw of the driver hereinafter described. The visible parts of the nut piece we usually make of gold or silver; and those parts not exposed to view, of brass. There are also, near the nozzle end of this tube or nut piece, two milled rims, by which it may be firmly held: *d*, the driver, made of steel, one end of which is cylindrical, fitting into and nearly filling up the nozzle. The middle part of the driver is formed into a screw, to work in the nut piece; the length of this screw part of the driver is somewhat more than the length of the cylindrical part. The other end of the driver is made semi-cylindrical, of about the same length as the screw, with a small part at the end, quite cylindrical: *e*, a short tube of brass, put on upon the semi-cylindrical part of the driver, having a steel pin through one side, to prevent the tube turning round upon the driver, but to allow it to slide the whole length of the semi-cylindrical part.

The outer diameter of this tube is the same as the outer diameter of the nut piece: *f*, a long brass tube, fitting upon the nut piece, *c*, and short tube, *e*, having a pin, *g*, to work in the circular groove, *h*, of the nut piece, and allow the tube to be turned upon the nut piece without coming off; and also a pin, *k*, going through its side, and into the side of the short tube, *e*, so that when the long tube is turned around, it shall carry the short tube around with it: *l*, a groove, around near the middle of the nut piece, to receive a wrapping of silk or other elastic substance, for the purpose of occasioning a small degree of friction, and thus of preventing the tube, *f*, from turning too easily: *m*, an outer tube of gold, silver, tortoiseshell, ivory, or other substance, fastened upon the brass tube, *f*, to form an ornamental handle to the pencil-holder or port-crayon. The whole of these parts being put together in their respective places as described, and as seen in the section, B, and the point of the pencil or crayon being worn away close to the end of the nozzle, if the milled rims are then held in one hand, and the handle, *m*, turned around with the other hand, it will carry around with it the tubes, *f* and *e*, and the driver, *d*, which, working in the screw of the nut piece, *c*, will be moved longitudinally, and drive or force the pencil or crayon out of the nozzle, to whatever distance may be required for use. When it is desired to make the holder draw in the pencil or crayon, as well as drive it out, we cut a female screw in the end of the driver, and screw the pencil or crayon into it; or we form, for a short distance, the end of the driver into a hollow cylinder, having thin sides, and cut three or more longitudinal slits in the sides, so as to render them elastic, and capable of embracing the end of the pencil or crayon: *n*, the end of the driver, made hollow, with slits in the sides, to embrace the end of the pencil or crayon. When the pencil or crayon is worn out, and the holder requires to be re-charged, hold two of the milled rims in each hand, and unscrew the nozzle; then put a new pencil or crayon into the screw end of the nozzle, the opening of the tube at that end being made conical, to facilitate the entrance. Before the nozzle is returned to its place, hold the two milled rims remaining attached to the handle, and turn the handle the reverse way to that which protrudes, and the driver will be drawn in; after which, the nozzle may be returned into its place, and the pencil or crayon is ready for use.

In describing this our most favourite pencil-holder or port-crayon, we have given no dimensions, because these must ever depend upon the size and length of the pencils or crayons to be used, which may vary from a quarter of an inch, or more, to the one fiftieth of an inch, or less, in diameter, according as the artist may require a bold line, a fine line, or an extremely delicate line; and from three inches, or more, to half an inch, or less, in length. But we sometimes make five or more nozzles, of different dimensions, to fix into the same handle, by forming the driver as shown in fig. 2, and having a separate cylindrical piece, L, M, N, O, to put on upon the driver, to fit each of the four larger nozzles respectively.

Fig. 3, section of a simple form of making the pencil-holder or port-crayon, in cases where the varying in length of the handle is no objection: *p*, the pencil or crayon: *q*, the nozzle, united with the nut piece; *r*, the driver, like the driver of fig. 1, except that instead of the semi-cylindrical end, it has a short cylinder at the end of the screw, fitting into the outer tube: *s*, an outer tube, fitting tightly on, and pinned to the larger end of the driver, and sliding freely over the nut piece. This tube projects far enough beyond the end of the driver to form a socket for a handle of wood, ivory, or other substance, *t*.

Fig. 4, section of a pencil-holder or port-crayon, differing from fig. 3 in having the male screw outside of the tube which corresponds to the nut piece, and the female screw within the outer tube, and in having the driver an equal sized cylinder throughout its length, except a short part at the handle end, larger, to fix it in the outer tube; this arrangement is adopted, and the diameters of the tubes increased, to make room for a reserve of six pencils or crayons, ready to be pushed into the nozzle, as it may be emptied by use: P shows the appearance of the end of the tube which corresponds to the nut piece, when charged with the six pencils or crayons: *u*, six short thin brass tubes, of the same diameter inside as the pencils or crayons are outside; these tubes are slit on one side to make them elastic, and soldered around inside the orifice of the tube which corresponds to the nut piece of fig. 1.

Fig. 5, a holder for holding pencils or crayons, nearly as long as itself: Q, another view of part of the same: R, transverse section from *v* to *v*, with end view of *z*: S, perspective view of the driver. This holder consists of a tube, *w*, having a slit nearly the whole length, and the outside of the tube cut into a screw, with a seal or cap screwed on at the end opposite to the writing end: *x*, the pencil or crayon: *y*, a short cylinder or driver, sliding against the pencil, having a stud sliding in and projecting through the slit: *z*, a milled nut, turning upon the screw of the tube, and pressing against the stud of the driver, to drive out the pencil or crayon at pleasure.

To charge this holder, take off the seal or cap, then the milled nut, and take out the driver; after which, put the pencil or crayon into the tube, which is made a little conical at the cap end, then return the driver to its place, against which screw the milled nut, and put on the cap; the whole is then ready for use.

For the sake of rendering our description less intricate, and of avoiding circumlocution, we have stated peculiar metals, metallic compounds and materials, for the various parts of our pencil-holders or port-crayons; but it is obvious that our invention is not restricted to the use of those respective metals or materials only, since, in order to suit the taste of many persons, ivory, tortoiseshell, or other substances, may be used instead of metal or the materials described, without altering the principles of our improvements. And we do further declare, that our said improvements on pens do consist, first, in making the pens of tortoiseshell or horn, and in impressing into the nibs or wearing parts of the said pens, when they are softened with water at near the boiling heat, small particles of diamond, ruby, or other very hard substances; by which means we combine great durability with pleasant elasticity. Secondly, in affixing to the wearing parts of tortoiseshell pens larger pieces of diamond, ruby, gold, or other hard substances, than could be used in the first plan, and securing the same in their places by soldering or cementing, according to well known methods, pieces of tortoiseshell over them, taking care that these pieces do not extend far enough backwards from the nibs to injure the elasticity of the pen. Thirdly, in lapping a small piece of thin sheet gold over the end of a piece of tortoiseshell, intended to be made into a pen; and pressing the gold into the tortoiseshell, while it is in a soft state, and afterwards forming the pen by cutting away the superfluous gold and tortoiseshell together. Fourthly, in applying to the nibs of pens, whether made of tortoiseshell, horn, or quills, small particles of diamond, ruby, or other very hard substances, and causing the same to adhere by means of any tough and hard varnish or cement that is not corroded by ink, such as copal dissolved in oil, shell-lac dissolved in alcohol, sealing wax, and the tough resins and resinous compounds soluble by heat, which are used by lapidaries for cementing their precious stones to handles, for the purpose of holding them to be cut and polished, taking care that the composition be such as not to require heat enough to burn or scorch the tortoiseshell, horn, or quill. And fifthly, in placing against the back of a pen two springs, or a forked spring of tortoiseshell, horn, quill, or metal, to be slidden towards or from the nib at pleasure, in order to increase or diminish the stiffness of the pen, to suit various kinds of hand-

Fig. 1.

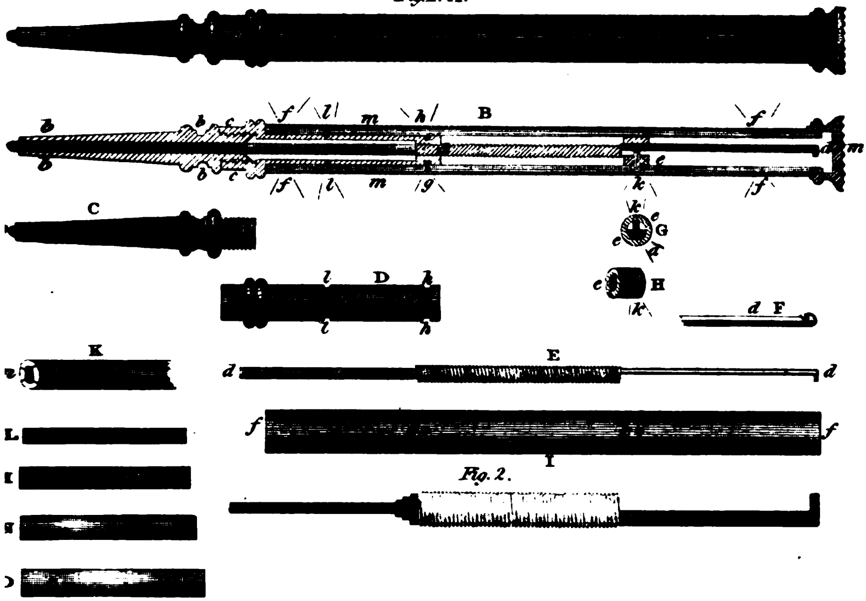


Fig. 3.

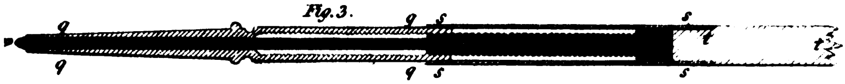


Fig. 4.

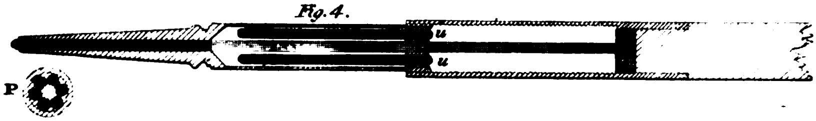
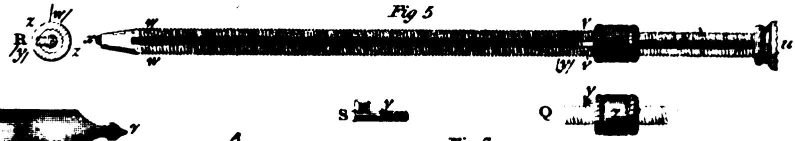


Fig. 5



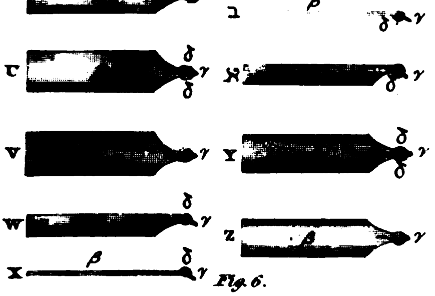


Fig. 6.

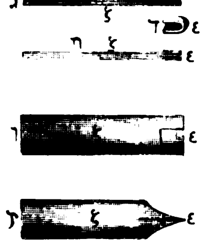


Fig. 7.

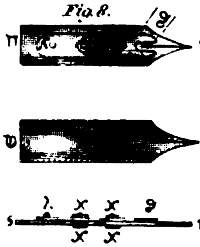


Fig. 8.

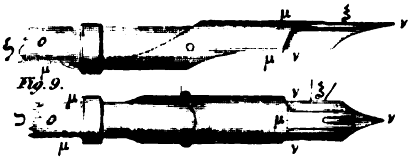


Fig. 9.

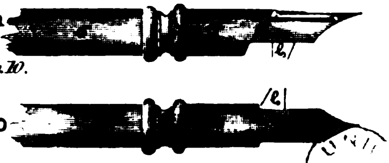


Fig. 10.

writings. In order to effect our first plan, we cut an indentation in a steel die, fitting the nibs of the pen, and place the particles of diamond or other hard substances in the bottom of the indentation; we then soften the nibs of the pen in water, nearly boiling hot, and lay them in the indentation, and immediately put on a piece of steel fitting the back of the pen, and apply a moderate degree of pressure, which we continue until the tortoiseshell or horn is nearly cold.

Fig. 6, exhibits different views of pens, with bits of diamond, ruby, or other hard substances, secured into the nibs, by soldering or cementing pieces of tortoiseshell over them, according to our second plan: T, represents a bit of diamond laid on each nib of a *tortoiseshell* pen, either on the back or inside of the pen: U, shows the back of a pen, with pieces of tortoiseshell soldered or cemented over the bits of diamond: V, the inside of the same pen: W, profile of the same: X, section in profile: Y, the inside of a pen, with pieces of tortoiseshell soldered or cemented to the inside of the nibs: Z, the back of the same pen: א profile of the same: ב section in profile: β the body of the pen: γ the bits of diamond: δ the tortoiseshell, cemented to the nibs, and inclosing the diamonds, except at their writing parts.

Fig. 7, represents five successive stages of a pen, manufactured according to our third plan: ג section, in profile, of the tortoiseshell prepared for the pen: ד perspective view of the thin piece of gold turned up into the form of a staple: ה the staple, lapped over the end, and pressed into the tortoiseshell: ו view of the same, as seen either at the inside or at the back: ז view of the pen, as it appears on both sides when finished: ε the gold: ζ the tortoiseshell.

In carrying our fourth plan into effect, we sometimes take two bits of diamond or other hard substances, formed to a proper figure, and dip them in the varnish, or melted sealing wax or cement, and immediately adjust them in their places in the inside of the nibs. And sometimes we mix a quantity of diamond or other hard substances, in grains not exceeding the two hundredth part of an inch in diameter, with about an equal quantity of varnish, sealing wax, or cement, and dip the nibs of the pens in the composition.

Fig. 8, shows the manner of placing a spring on the back of a pen, to increase or diminish the stiffness of the nibs, according to our fifth plan: ה view of the back of a pen: ט view of the inside: ι section in profile: η the pen: ϑ a forked spring, one prong of which presses upon each nib of the pen: κ two rivets and four washers, the rivets passing through two holes in the pen, and through two slits or mortices in the body of the spring: λ a knob, by which the spring may be slidden. In the case of portable or fragment pens, we sometimes affix the forked spring to the back of the holder, in the same manner as just described, for the back of a pen; and sometimes we make the forked spring a mere prolongation of the back or upper jaw of the pen-holder, and adjust the degrees of stiffness of the pen by putting it to a greater or less depth into the holder.

Fig. 9, shows a common portable pen-holder, with the back or upper jaw prolonged into a forked spring: כ view of the back of the holder, spring, and pen together: ϐ profile of the same: μ the pen-holder, usually extending no further over the pen than the dotted line: ν the pen: ξ the spring: ο the handle.

Fig. 10, another common portable pen-holder, with which the forked spring is united by a prolongation of the ferrule: ס view of the back of the holder, spring, and pen together: ג profile of the same: ϖ the pen-holder, usually extending to the dotted line: ϱ the spring: σ the handle.

In witness whereof, &c. &c. &c.

Specification of the Patent granted to RICHARD BADNALL, *the younger, of Leek, Staffordshire, Silk Manufacturer, for improvements in the manufacture of silk.* Dated July 20, 1826.

WITH A PLATE.

TO all to whom these presents shall come, &c. &c. *Now know ye*, that in compliance with the said proviso, I, the said Richard Badnall, the younger, do hereby declare that the nature of my said invention, and the manner in which the same is to be performed, are particularly described and ascertained in and by the drawings hereunto annexed, and the following description thereof (that is to say):—Figs. 1 and 2 (Pl. X.) represent a side view and plan of a machine for winding silk, or any other fibrous substance: A A are swifts on which the hank of silk or other fibrous substance is placed or stretched in the ordinary manner: B B are pulleys, firmly attached to the axis of each swift, with a groove in them from which a band or cord passes round the smaller pulleys, C C. Motion is communicated to the pulleys, C C, by the driving wheels, D D, which are actuated by any convenient power. The periphery of the driving wheels, D D, and of the pulleys, C C, being in contact with each other, of course when the former are set in motion the latter also are caused to revolve, and consequently the swifts likewise upon which the silk is placed or stretched. Upon the periphery of the driving wheels, D D, are placed small wheels, E E, to which the spindles are attached which carry the bobbins upon which the silk is intended to be wound from the swift, as may be seen by reference to fig. 2, where *a a* represent the bobbins: F F are levers, which act under the pivots of the spindles of the wheels, E E, upon any tension being applied to the longer arms of the said levers, the fulcra being placed as near as convenient to the point where the shorter arms of the levers come in contact with the pivots of the said wheels, E E. Having described the separate parts of this machine, it is now only requisite to state the effect which takes place when put in motion. On power being communicated to the driving wheels, D D, motion is thereby communicated to the pulleys, C C and B B, and also to the small wheels, E E, which carry the bobbins. The consequence of this is, that a revolution of the swifts, A A, is occasioned, and by a proper calculation of the diameters of the pulleys, B B and C C, and of the small wheels, E E, and the receiving bobbins which are placed on the spindles of the same, the silk given off by the swift will be received by the bobbin. To regulate, however, any variation caused by the increase of silk on the bobbin on becoming full, and its consequent increased circumference and decrease of the hank, the levers, F F, are brought into action; for on the slightest increased pressure of the thread or threads which pass over the levers, F F, the pivots of the wheels, E E, are instantly acted upon, and they are consequently raised from contact with the driving wheels, D D, and the speed of the bobbin retarded until a further supply of silk be given off from the swift. From this it is evident, that unless the silk be previously broken in the hank, it is next to an impossibility for any breakage to occur in the winding of the same, as the lever is at all times the compensating power or mediator between the swift and the bobbin; and as it is so arranged as to be elongated or shortened at pleasure, it can be accommodated to every description of silk or other fibrous substance. It is necessary to state that the silk should pass over the glass rails, H H, from thence over the levers, F F, through the eyes or guiders, G G, and from thence to the bobbins. By this improvement in winding silk, the great difficulties, cause of waste and expense in time, &c. which attend the customary method, are effectually avoided; and what is an object of the greatest importance, any desired speed may be obtained, an increased motion of the swift by no means adding to the tension of the silk.

Fig. 3 represents another arrangement of the foregoing mechanism, which is perhaps preferable for all kinds of silk, and has the advantage of being applicable to that description termed long-reeled. A is the driving wheel: B the receiving bobbin: C the compensating lever, similar to the like parts in figs. 1 and 2; but instead of employing a swift, the silk is stretched on two cylinders, D E, of tin or other material, technically called rise heads. The upper rise head, D, resting on the driving-wheel, A, is actuated in the same manner as the band wheel, C, in figs. 1 and 2. It will therefore be easily understood, that the silk being stretched over the two rise heads, D E, and the upper one, D, being put into motion by the driving wheel, A, it will revolve round in the manner of an endless strap or band, giving off its thread to the receiving bobbin, B, in the manner shown in the annexed drawing. The lever, C, acts in this arrangement exactly in the mode described in figs. 1 and 2, and therefore need not be described again. To prevent the silk from getting entangled, which it might do were the skein allowed to pass from one rise head to the other without any support, it is made to pass over a plane of tin or other suitable material, F F, of the same breadth as the skein of silk, or what is the same thing, the two rise heads, D or E: its sides are turned up to prevent the silk from running off it. It is shown detached in fig. 4. The rise head, E, has the power of being moved to a greater or less distance from the rise head, D, to accommodate itself to the length of the skein of silk by means of the screw and slide, G; and in order to allow the plane, F F, to accommodate itself likewise to the rise heads, it is divided into two or more pieces of any length, which being placed as at *a*, *b*, *c*, *d*, one under the other, admit of any degree of extension short of the united length of the several pieces of which it is composed.

In fig. 1, X is a small ratchet, to prevent the silk from being wound off again from the bobbins, E E, which sometimes happens when the silk gets fastened on the skein. This apparatus is more plainly shown by fig. 5: A is the driving wheel that carries the receiving bobbin: B B is a small standard of metal, fixed to the frame of the machine: C D a piece of metal, attached by the hinge, D, to the standard, B B, and swinging, like a pendulum, in the direction of the dotted line, but prevented from taking an opposite direction by the small peg, E. From the face of the wheel, A, projects another small peg, F, so placed as in each revolution of the wheel, A, to strike the ratchet, C D. Hence, when the wheel revolves in the direction of the dart (its proper course) once in each revolution, it elevates the ratchet, C D, in the direction of the dotted line, and passes it; but should any thing drive A in a contrary direction, the peg, F, coming in contact with the piece, C D, which is itself prevented moving in any but the first direction by the peg or stop, E, stops the wheel, A, from revolving at all.

Figs. 6 and 7 represent an elevation and plan of an improved machine for doubling silk or other fibrous substance. Any number of bobbins on which the silk or other material has been previously wound, are placed in an upright position on any suitable frame or board, B B, and according to the number of threads wanted to be doubled, such number are passed between the rods or bars, C C C (which are constructed of glass, or any other suitable material), and separately conveyed through the small loops or eyes of the wires, *a a a*, and from thence through the guider loop or eye, *b*, to the receiving bobbin, D. The glass rods or bars, C C C, are fixed in an upper and lower frame, the upper one being moveable on hinges, *c c*, so that instead of passing the silk under one bar and over the other, the same is immediately effected by the top frame being raised, and when the threads are passed over the lower frame, let down again, which forms upon the silk such angles or curves as may be seen by reference to fig. 8, and by which means sufficient friction is produced to lay the silk with proper tightness on the bobbin, D, and to keep the loops or eyes of the wires, *a a a*, elevated as long as the threads continue whole: E is a lever exactly balanced, one end of which has a plate of tin or other suitable substance attached to it, and which plate is placed exactly under the wires, *a a a*, so that if any of the said wires, by the breaking of the thread which elevates them, should fall, the end of the lever upon which it falls (namely, the plate of tin or other substance above alluded to), would immediately preponderate, and the opposite end consequently be elevated. On the spindle upon which the receiving bobbin, D, is placed, is a kind of ratchet or stop, F, which catches the end of the lever, E, the moment it is elevated, and stops the bobbin until the end which was broken (and caused this stoppage) be pieced. Motion to the bobbin, D, is communicated by the driving wheel, G, fig. 6, acting upon the small wheel, H, which is attached to its spindle.

Fig. 9 represents a bobbin, A, at the top of which a circular rim, B, of polished metal or other suitable substance, whose surface is not liable to be injured by ordinary wear or use. The use of this is to prevent the breaking of threads by what frequently occurs where the common guider or flyer is used. It is necessary here to remark, that this circular metallic rim may be either loose or attached to the bobbin. The former, for most purposes, I prefer, particularly in its application to throwing, where, by a reference to the following figures, 10 and 11, the advantages resulting from it may be easily distinguished.

Figs. 10 and 11 are a side and front view of my improved machine for spinning, doubling, and throwing silk by one operation, which were patented on the 18th day of April, in the year of our Lord 1823, and specified accordingly. The intention of introducing it here is to include some further improvements on it.

Fig. 12 represents a bobbin and guider or flyer, as commonly used, to which guider or flyer I chiefly attribute the greatest portion of the waste made in the throwing of silk. The causes of this are obvious. The guider or flyer, A, moves loosely on the spindle; to this spindle the bobbin, B, is firmly attached. The considerable friction and strain is therefore produced upon the silk by the power required to draw round the guider or flyer, A, independent of the angular position which it necessarily takes in being drawn off the bobbin. To counteract this, therefore, the circular metallic rim, as described in fig. 9, is substituted, whether attached to the bobbin or placed loosely upon the top of it.

In figs. 10 and 11, A A are bobbins, upon which the silk has been previously wound or doubled, according to the description of manufactured article required. At the top of these bobbins are, either attached or placed loosely, the circular metallic rims, B B, which I call "waste preventers," and which are made to extend about one fourth of an inch beyond the circumference of the bobbin. C is a rectangular bar of wood or metal, covered with woollen cloth, or any other material capable of producing friction. Over this bar, and once or more round it, as required, the ends of silk are taken from the bobbins, A A, and conveyed through the loops or eyes, D D, through the rollers, E E, to the receiving bobbin, F. Motion is given to the spinning spindles, G G, and to the throwing spindle, H, by an endless strap, band, or chain, I I, passing between their whorls or stockings, as described in the drawing annexed, which strap is actuated by a drum or cylinder in the usual manner. It is evident, on reference to the drawing, that if the strap be set in motion, the spindles, G G, will be revolving in an opposite direction to the spindle, H; and

[illegible]

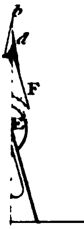
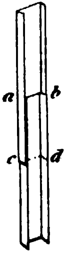


Fig. 4.



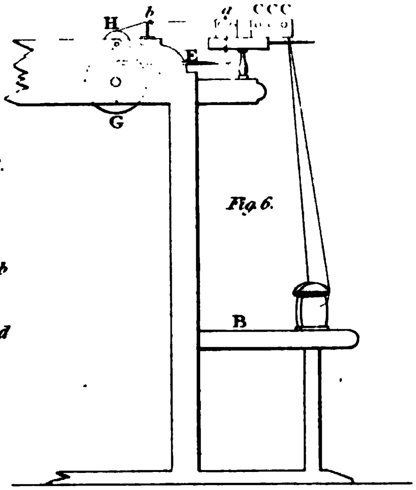


Fig. 6.

Fig. 7.

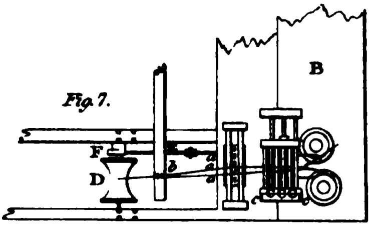


Fig. 8.

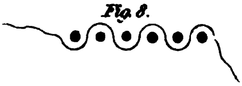


Fig. 9.

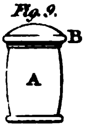
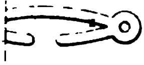


Fig. 13.



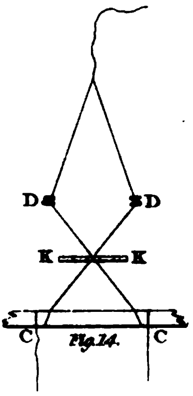


Fig. 14.

if the rollers also be set in motion, which motion is regulated so as to suit the exact quantity of twist the kind of silk requires, the silk will be drawn from the bobbins, A A, and received on the bobbin, F, in the usual manner of cotton spinning. The bobbin, F, being loose upon its spindle, and the flyer attached fast to it, a sufficient friction for all necessary purposes is produced by passing the silk round the covered rail or bar, C. By this contrivance the guider, A, as described in fig. 12, is rendered useless, and consequently the breakage of threads very materially diminished. Independent of the above great advantage arising from the use of the "waste preventers," they allow a very great increase in the speed, to which the guiders commonly in use were an insurmountable obstacle, in consequence of the centrifugal action being so great as to cause an extension of the wires when they very frequently came in contact with each other; and this happened particularly in this method of throwing when it is necessary to have the receiving or throwing spindle as close as possible to the giving off or spinning spindles. In case the thread or threads from either of the spinning bobbins, A A, which unite at the rollers, should break, a cutter, as described in fig. 13, is provided, which is placed on the lower part of the frame, K K, which frame also supports the rollers, and by passing the two ends of the silk over the cloth bar, C C, then crossing the threads round each other, and then passing them through the upper loops or eyes, D D, they maintain, as long as they remain unbroken, a situation as shown in fig. 14; but as the points, 1, 1, of the cutter, as described by fig. 13, are two small pieces of sharpened steel; on the breaking of either thread, the remaining one, being liberated, will immediately come in contact with one of the said pieces of steel, and be instantly cut.

According to the diameters of the whorls or stockings, which are fixed upon the giving off spindles, G G, and the receiving spindle, H, will be the proportion of twist or spin between them, and according to the speed of the rollers will be the twist or spin given to the united threads.

It is here necessary to state, that by means of the above described cutter and circular metallic rim, with the cloth friction bar, the two operations of doubling and spinning may be performed at one time on the common spinning mills. The mode of doing this will be easily understood by referring to fig. 10, and supposing the rollers, E E, to have their place supplied by the ordinary receiving bobbins of such mills, while the receiving bobbin, F, of the mill is taken away altogether. If then the two threads are carried from the two spinning bobbins, A A, in the manner described in the plate, to the receiving bobbin that has taken the place of the rollers, E E, they will be gathered on that bobbin, having been first spun by the revolutions of the two bobbins, A, and thus doubling and spinning in one operation.

In figs. 1 and 2, I claim any means of giving motion to a swift, rise head, or any other reel upon which silk may be placed for the purpose of being wound on to the receiving bobbin, at the same time, in conjunction with a compensating apparatus, or any imitation thereof whatever, whereby the same effect may be produced; that is, I claim any means, in conjunction with an apparatus which can, through the agency of the silk, retard or accelerate the receiving bobbin, whereby silk can be conveyed from a swift, rise head, or reel, on which it is placed to be wound to a bobbin which is to receive it, without any friction or tension being employed upon it, except that which is necessary for its action upon the said apparatus, and consequent self-preservation, and for laying it with a proper tightness on the bobbin, and which tightness may be increased or diminished at will, by increasing or diminishing the action of the said apparatus on the bobbin itself.

In fig. 3, I claim the arrangement there described generally, and particularly the channel of metal or other material, F F, for supporting the skein in its passage from one rise head to the other.

In figs. 6 and 7, I claim the use of rods or bars of glass, or any other suitable substance, as heretofore described, by passing the silk under and over which, a sufficient degree of tension is produced to lay it well upon the receiving bobbin, whereby the wire guiders commonly in use are rendered unnecessary, and much breakage and waste consequently prevented; if one or two of these rods or bars be covered with woollen cloth, or any other suitable substance, it would tend much to clean and brighten the silk, and to prevent loose ends running up. In the figs. 6 and 7, I also claim the particular arrangement, as described in the drawings of the loops and wires, *a a a*, which are made so peculiarly light and small as to produce but the slightest tension on the silk, and yet sufficiently heavy to answer every purpose.

In figs. 10 and 11, I claim the general arrangement of the machinery, the particular arrangement of the cloth bar, waste preventer, with the cutter, and the application of the same peculiar arrangement of parts to the common spinning mills, for the purpose of doubling and spinning at one operation.

Lastly, I claim, whether for this or any other purpose, the exclusive application of the circular polished metal rims, or other suitable substance, whose surface is not liable to be chipped or injured in ordinary use, termed "waste preventers," as a substitute for the old flyers.

In witness whereof, &c. &c.

Remarks on Messrs. Hills *and* Haddock's *Patent, for an improvement in the manufacture of Sulphuric Acid.*

By Mr. J. C. Gamble, of the Liffybank Vitriol Works, Dublin.

COMMUNICATED BY THE AUTHOR.

The patent of Messrs. Hills and Haddock (the specification of which is inserted in the last Number of the Repertory), on its first appearance attracted much attention from the manufacturers of sulphuric acid. The accurate experiments of Mr. Hatchett had made known the immense quantity of sulphur contained in iron pyrites. It was also known that by roasting this pyrites at a low red heat, in contact with atmospheric air, the sulphur is disengaged, and sulphurous acid produced in great abundance. And the French chemists, Clement and Desormes, had proved, that in the common mode of manufacturing sulphuric acid the use of nitre is to give out nitrous acid vapour, which, acting as a medium of union between the atmospheric oxygen and sulphurous acid vapour, produces a substance which, by the agency of water, is ultimately converted into sulphuric acid.

Now the above facts being known, nothing could be more plausible than to suppose that sulphurous acid vapour, extricated from burning pyrites, and conveyed into a chamber with the requisite portion of nitrous acid vapour, would produce sulphuric acid with the utmost economy and advantage. Accordingly, two extensive manufacturers, under licences from the patentees, soon commenced the new process. But it would appear that that trial disappointed their expectations, for they have since abandoned it. A third house, Messrs. Thompson and Hill's, of Liverpool, still continue the process; probably because, being their own miners, they have the advantage of using their own pyrites.

The writer made trial of this process under infinitely varied modifications. He embarked in it with the more spirit, and prosecuted it with the more determined perseverance, because he conceived that his vicinity to the immense stores of pyrites deposited in the mines of Wales and Wicklow, gave him a great local advantage; and in abandoning it he was left with little hope of ever seeing it prosecuted with success.

He used a cast-iron retort, through which the sulphurous acid vapour and atmospheric air were conveyed into the chamber, perfectly apart from the smoke of the furnace. He operated sometimes on half a ton, sometimes on three times that quantity of pyrites, daily. He experimented at every degree of heat, at which the gas could be extricated, from the lowest red to the highest the retort could bear. He subjected the material to incandescence for every period of time from two to twenty-four hours. He conveyed the gases into the chambers with a velocity differing from a smart to the least possible current. He made trial without nitre; but finding he could not effect the least condensation in this way, he soon gave it over. The nitrous acid vapour was disengaged from nitre by sulphuric acid, and conveyed to the chamber by a separate passage. The quantity of nitre varied from a sixteenth to a thirty-second part of the pyrites employed. Sometimes steam alone, at others, steam in conjunction with atmospheric air, were introduced into the chamber by a distinct passage, and under various modifications; at other times both these agents were excluded. In short, every contrivance that could be thought of was put to the test, and always with the same ill success. Sulphurous acid gas was always produced in immense abundance, but could not be condensed. One half of the sulphuric acid produced in a given time by the old mode of working could not be obtained in this. And as the principal investiture of the manufacturer's capital is in the leaden chambers, so great a deficiency in their produce would, under any circumstances, terminate in failure. In the above trials the gases passed through a range of chambers two hundred and forty feet in length.

On taking a closer view of this subject, we think nothing occurs that might not, *à priori*, be expected. Common pyrites, or, as we shall now call it, bisulphuret of iron, is, in round numbers, composed of fifty-two parts sulphur, and forty-eight of iron. When this bisulphuret is submitted to a low red heat, in contact with atmospheric air, it gives out one half its sulphur, which is converted into sulphurous acid gas, and the residue becomes a protosulphuret. But owing to the great affinity of iron for oxygen at an elevated temperature, this protosulphuret coming in contact with a fresh portion of atmospheric oxygen, will give out the remainder of its sulphur, and be converted into a red oxide. These combinations thus proceed with more or less rapidity during the process; and should it be continued, the residue will be a red oxide, entirely deprived of sulphur.

Now the atmospheric air, in passing through a ton of pyrites, has to furnish more than half a ton of oxygen to the sulphurous acid, and four-fifths of that quantity to oxidize the iron; so that very nearly a ton of oxygen must be set off for these purposes before a particle can be appropriated to the conversion of sulphurous to sulphuric acid within the chamber. As atmospheric air contains about one-fifth oxygen, five tons of it must pass into the chamber, and yet no allowance be made for the conversion of the sulphurous to sulphuric acid; the volume of which I shall leave to your readers to determine.

I will admit that this is putting the matter in the most unfavourable point of view; because, in ordinary proceedings, the residue will be partly a protosulphuret, and partly red oxide. But it is a true representation of what always occurs in a more or less degree.

Yet the difficulty does not end here. For though oxygen be present in the chamber, but so diluted as to form but an inconsiderable proportion of the general mass, the union of the sulphurous and nitrous acid gases became extremely difficult, and at length impracticable. This fact the experience of every vitriol manufacturer has taught him. He has observed how briskly condensation proceeds at the commencement of combustion, when the atmosphere within the chamber maintains its due proportion of oxygen; but as that proportion diminishes, the condensation becomes languid, and at length ceases, before the materials are exhausted.

The Messrs. Vivians, the intelligent proprietors of extensive copper works in the neighbourhood of Swansea, employed a number of ingenious devices to condense the immense volumes of sulphurous acid vapours disengaged in the roasting of their ores, to the serious annoyance of the surrounding neighbourhood. They were advised to convey these vapours into a leaden chamber, and there meeting with nitrous vapour, it was hoped they would be condensed into sulphuric acid, and that thus two important objects might be gained—the manufacture of a valuable product, and the abating of the nuisance. But the result was altogether unfavourable. The large quantity of foreign gases prevented the union of the sulphurous and nitrous acid vapours, and no sulphuric acid was obtained.

The patentees seem to have observed a studied ambiguity in their specification, with regard to the use of nitre in the process. They state that they ignite the metallic or other sulphurets in contact with atmospheric air, or other imponderable substances containing oxygen. There is no such thing as imponderable substances containing oxygen. But to waive this mistake, they should have explicitly declared what they did use to afford oxygen in their process. If it was nitrous vapour they should have said so, and not leave the public, at the expiration of their monopoly, to commence a series of experiments to discover their meaning.

But it would appear, from evidence produced by them on the trial against Thompson and Hill, that they did intend the public should believe they manufactured sulphuric acid without nitre. On this trial two celebrated chemists were produced, to prove that they attended to the process at Bromley for several days, that they noted its progress, and that sulphuric acid was produced without nitre.

Though nothing can be more remote from my intention than to question the veracity or ability of these distinguished men, yet I think I shall be able to show there is reason to doubt that even the small quantity mentioned in their report was produced without nitre. With regard to the experiment itself, all that can be said about it is, that it was not performed within their own laboratory, or within the circle of their constant observation. The patentees themselves, when conferring with others respecting the use of their privilege, always introduced a full portion of nitre as one of the items of expenditure. In the trials I made without nitre, no sulphuric acid was produced; and the evidence of Sir Humphry Davy may be adduced in support of this fact. He says, Chem. Phil. p. 275, "Let a porcelain tube be heated red, and the strongest sulphuric acid passed through it in vapour, a part of it will be decomposed." It is quite legitimate to infer from this experiment, that if it were continued the entire of the acid would be decomposed. Of consequence, a result the reverse of this could not be expected. I am aware that some of the older French chemists have advanced a contrary opinion. But, besides that the experiment of the illustrious President will outweigh a whole host of these, the disintegrating power of heat seems best to accord with the general analogies of nature, and the experience of facts.

Since the capital discovery of Clement and Desormes, the improvement and consequent reduction in price that have taken place in the manufacture of sulphuric acid in the ordinary way, are likely to render abortive all attempts at competition grounded on the decomposition of metallic sulphurets; especially as long as we maintain our present friendly relations with the southern states of Europe.

Plan for a Tunnel under the Thames.

By Horticus.

Abstracted from the Papers and Documents of the "Thames Archway Company."

The tunnel proposed by Horticus was to be made externally of wrought iron plates, supported inside by cast iron ribs. These ribs were to be composed of several pieces, each about 6 feet long, forming a portion of a circle of the section of the tunnel, and scarfed at each end similar to the timbers of a ship, but having the scarf at one end faced the reverse way from that at the other end, and all the scarfs about two feet long. By this arrangement the scarf of one piece would lap over that of the next piece successively all round, till the whole circumference was completed; which was to have been of large extent, as the tunnel is represented in the drawings to be 23½ feet in diameter from outside to outside, according to the scale.

Sixteen pieces of the above description are united in each rib by screws, which pass through two pieces at the scarfs into the plate iron at the outside; the wrought iron plates were to be rebated at the edges, were to be but 2½ feet long (from the scale), were each to cross two ribs, and were to be so arranged lengthways that the joints of one row were to be opposite the middle of the plates next adjoining.

From the drawings the ribs were to be 1 foot asunder, 3 inches broad, and 4½ thick.

There was to have been a water course at the bottom of the tunnel, 4 feet high, arched over and formed of bricks; and over this, chalk was to have been filled in, to raise the level of the road, inside, 8 feet above the lowest part of the bottom, outside. There were to have been footways at each side, 3 feet broad, supported by iron knees, forming one piece with the ribs, at the line where they crossed those ways. The tunnel was to have been lighted with common lamps, and the degree of its slopes downwards at each side, the place of its staircases, and its general direction, were all nearly the same as those of the generality of the other plans.

The great size of this circular tunnel, and the large quantity of iron which it required from the close position of the ribs, would altogether have made it very expensive; but as it might evidently be altered in these particulars, affords facilities for putting it together in short lengths, as the excavation was made for it beneath the river, and possesses considerable ingenuity; it appears to us deserving of some consideration.

Of Lime which hardens in Water. BY M. HASSENFRATZ.

(Continued from p. 178.)

We in consequence had sent to the celebrated M. Vauquelin a portion of the lime of Senonches, from a new parcel, which had fallen in efflorescence by its being exposed to the air; and requested him to analyze it, after having informed him of the difference which was remarked in the results of those of MM. Vitalis, Descotils, and ourselves. The following is his reply.

Ten grams of this lime, in the state in which it was sent to me, having been dissolved in muriatic acid, the combination took place with effervescence.

Of these ten grams of lime, three decigrams of silex, in a very divided state; resisted solution.

The solution, which was of a yellowish colour, being evaporated to dryness, assumed, before arriving at that state, the gelatinous form.

The salt which it produced being re-dissolved in water, sharpened with muriatic acid, deposited a granulated matter, slightly redish, which was silex, mixed with an atom of iron oxide, which weighed five decigrams.

The liquor which had given this silex being mixed with ammonia, threw down a yellowish precipitate, which, treated by a solution of caustic potash, gave on one part ten centigrams of alumen, and on the other fifteen centigrams of iron oxide, mixed with an atom of magnesia.

Ten grams of this lime having lost three grams by calcination, causes the analyses to be the same as if the operation had been performed on only six grams and eight-tenths of pure lime.

In consequence, this lime contains, in a hundred pounds,

1st, Pure lime	84·56
2d, Silex	11·70
3d, Iron, mixed with magnesia	2·20
4th, Alumen	1·54
	100·00

If the lime had been in the state of carbonate, the proportion of silex would have been 0·07.

In comparing these analyses, it will be seen that those of M. Vanquelin and of M. Descotils agree in their finding but a very small quantity of alumen, and that a portion of the silex, in the limes which they examined, was in a state of combination. It may also be seen, that the analysis of M. Vanquelin agrees with that of Vitalis and ours, in the proportion of silex, which is 0·07 in the analysis of M. Vanquelin, 0·06 in that of Vitalis, and

0·057 in ours. It may finally be perceived that these three latter analyses differ from that of M. Descotils, which makes the quantity of silex a fourth or 0·25, while it is at most only a fourteenth, or 0·07, in the analysis of M. Vauquelin, who found in it the largest proportion of the three in the lime.

Four hypotheses have been successively proposed to explain the hardening property of the limes which are employed in water. Bergman attributed it to manganese; many scientific men to iron oxide; Smeaton to a proportion of alumen, varying between 0·06 and 0·20; Saussure and Descotils to silex. Whether this property is caused by one of these substances exclusively, or by the three separately or conjointly, is a question which should be examined and discussed as much as the actual state of our knowledge will permit.

Bergman having found manganese in the stone of Lena, attributed to this metallic oxide the hardening property of the lime, without examining or knowing if other causes or other substances had an influence on it. Guyton having found that this earth contained silex in a considerable propportion, would lead us to adopt the hypothesis of Descotils, and attribute its hardening quality to silex. Finally, as this stone likewise contained oxide of iron, we may also regard the oxide of iron as the cause of the induration; but the experiment of Guyton, who obtained a mortar that hardened beneath water, by calcining 90 parts of marble, 6 of manganese oxide, and 4 of clay, and then kneading this lime with 60 parts of silex, this experiment, we assert, is an absolute proof that the oxide of manganese contributes to the hardening of the lime.

If any one would desire, nevertheless, to attribute the hardening to the siliceous sand, which is mixed and worked up with the lime to make the mortar, we would observe, that in whatsoever proportions sand, purely siliceous, may be mixed with lime, it will contribute nothing to the hardening of mortar made with rich lime; and if we must cite other experiments besides our own, we may here recount those of Smeaton.

'Whatever was the proportion (says this excellent architect) of the mixture of sand and lime in the balls, strongly worked up, their remaining under water always destroyed them if they contained no other ingredients.'

As all the lime-stones proper for producing mortar, which hardened in water, that were analyzed by Saussure, Smeaton, Guyton, Vauquelin, Descotils, &c. and which gave no indications of magnesia, nevertheless contained oxide of iron, silex, and alumen, it would be difficult, without a new examination, to be certain if the hardening property belonged to the one or the other of these substances separately, or to these substances combined two and two, or three and three. Here the observations of Smeaton again serve to facilitate the solution of the question.

'The analysis, says this engineer, which shows in the composition of these stones clay and sand, although it affords a strong prejudice in their favour, *is not always a sure indication;* but this latter character, joined to *the yellow colour* of the lime, always announced the true meagre lime, that is to say, the sort that hardened in water; but it is easy to perceive that this yellow colour proceeds from the iron oxide, from whence it results that it was to the iron oxide, and not to the silex or the clay, that the hardening property belonged; or more properly, as Smeaton believed, to the union of the three substances.

Another observation which seems to favour this conclusion is, that rich limes, mixed and worked up with siliceous or argillaceous sand, produce mortars which the water attacks, dissolves, and decomposes; while, when they are formed of two parts of slacked lime, and two of terras or pozzolana, or even of iron scoria, all substances which contain iron oxide, they perfectly resist the action of water.

Wishing to clear up this question further, and to solve it by direct experiments, we made mixtures of the lime of

Chateau Landon, and of pure siliceous sand, in different proportions, that is to say, $\frac{1}{10}$, $\frac{1}{8}$, $\frac{1}{6}$, and $\frac{1}{4}$; we enclosed these mixtures in crucibles, and had them conveyed to M. Brongniard, the Engineer of Mines, Director of the Royal Porcelain Manufacture at Sevres, who had the goodness to have them exposed to the fire for porcelain, in causing them to be placed in the kilns, along with the matters which were to be baked in them. The crucibles having been sent back to us after being taken out of the kilns, we observed at once that the silex was perfectly combined, and that the lime slacked well, though slowly. Having mixed this lime with twice its weight of siliceous sand, which corresponds nearly with equal volumes of quick lime and sand, or to two parts of slacked lime and one of sand, all the mortars which we formed with those four sorts of lime were attacked by water, and became entirely diluted by it. The same mortars, dried in the air, without being exposed to the action of water, acquired little coherence, and were broken with extreme facility.

However positive this last result might be, we will not conceal that it is contrary to the opinion which we had formed of the great effects which, it appeared to us, ought to result from the action of the lime on the silex during their common calcination; so natural did it seem to conclude that a different result would be produced by this action from that which experience has afforded.

We have made, on the combinations of lime and alumen, experiments analogous to those with lime and silex; we mixed it with alumen, in the proportions of $\frac{1}{20}$, $\frac{1}{10}$, $\frac{1}{8}$, $\frac{1}{6}$, $\frac{1}{4}$. After calcination, the limes proceeding from these combinations slacked perfectly, although with a little more slowness than pure lime; and the extinction was so much more slow as the lime contained more alumen. These limes, mixed with double their weight of siliceous sand, produced mortars which became hard in the air, which acquired a considerably strong adhesion, but which could not resist the action of water.

Having repeated the same experiments with these combinations of lime and the oxide of iron or of manganese, we obtained limes which slacked more or less easily, according to the proportion of the oxide mixed, and the degree of temperature which they had experienced. When the temperature was too high the mixture began to vitrify, and we obtained a species of lava or of scoria, which had not any of the properties of lime; but whenever the temperature was sufficient to calcine the stone perfectly without vitrifying it, the lime obtained slacked completely, and presented qualities which depended on the proportions of the oxide in the mixture. When the oxide exceeded from 0·12 to 0·15 of the mixture, it was extremely difficult to dilute it; and when the proportion was less, the lime could not be made to become embodied; the lime often solidified in the air. We repeated these experiments many times, from our being persuaded that the oxides of iron and of manganese ought to give to lime the property of becoming hard; nevertheless, this lime seldom hardened alone, but on adding to it some siliceous sand, we succeeded in making excellent mortar of it, proper for building in water.

These experiments were repeated on calcareous stones, which contained naturally considerable proportions of the oxide of iron, or of manganese. We had different pieces of it calcined, which contained from 0·15 to 0·25 of the oxide of iron or of manganese. The engineer, Bredif, repeated the same experiments also on the carbonated ferriferous and manganesiferous lime of Pesey; and as the results of both perfectly agreed, we will transcribe the details which M. Schreiber, Divisionary Inspector, sent us on this subject.

Six pieces were put, each in a crucible, with a piece of common lime-stone, which was employed in making the lime that was used in the vicinity.

Each of these six crucibles was exposed to different temperatures, from a dull red to a white red.

In the five first, the common lime-stone produced a very good lime. In the last it was slightly vitrified at the surface, which was the reason that piece did not sensibly slack; but on breaking it, the fragments slacked readily in water.

The six pieces of carbonated ferriferous and manganesiferous lime of Pesey, all gave the same results. They slacked but very slowly in water.

A slight hissing and a very small heat were produced; and they did not become diluted like common lime-stone: in a word, they had not the qualities of pure lime. These pieces, on being calcined on charcoal, became of a blackish brown, attractible by the magnet.

It is evident, after these observations, and the discussions which have been determined, that the oxides of iron and of manganese are but little favourable to the hardening of lime and of mortar in water, unless in some particular cases.

Among all the limes which have hitherto been examined, there is one which appears to have escaped the researches of the men of science and builders, who have desired to know the causes of the different effects which they produce. This is magnesian lime.

This species of lime is more common than is believed. The calcareous stones which exist in the alpine chains, and in all the primitive formations, contain, more or less, considerable proportions of magnesia. The first observations which were made on this species of stone are attributed to Dolomieu, who distinguished them by the property which they have of producing only a very slow effervescence with acids, and of becoming phosphorescent by friction. After that, the cause of this slow effervescence was investigated, and it was found that it depended on there being a portion, more or less great, of carbonated magnesia combined with the lime; thus the lime-stone of Sesia contains 10·41 of magnesia to 31·70 of lime, according to the analysis of Napione. Accounts of the limes of the country of Genoa have been given to us by

M. Cordier, Divisionary Inspector of Mines. That of Giezo contains 0·84 of lime, and 0·16 of magnesia; that of Cocaletto, 0·96 of lime, and 0·04 of magnesia. Finally, the limes of Savone, those of Vado, those of Dissoverda, of Saint Martin, of Paravissino, of Pignone, contain 0·05, 0·08, 0·07, 0·05 of magnesia.

All these limes are much esteemed in the countries where they calcine the stones that produce them. A great commerce is made of those last; they are employed in preference for buildings made in water. The stone of Sesia contains 0·01 of iron. We are ignorant whether the others contain it likewise: many carbonates of lime and magnesia, such as the gurascien, the massy dolomite, the dolomite of Castellamarc, the grecian marble, the antique marble, &c. contain no iron oxide; others hold it in a very large proportion. Among these latter, we particularly note the dolomite of Mount Vesuvius, the lime-stone of Westminster, and the lime-stone of York Minster, Those of Bredon, of Tarpe, of Matlock, &c. &c. contain iron oxide, and often oxide of manganese, in larger or smaller proportions.

It would be difficult for us to pronounce, from the nature of these stones, if the property which their lime gives to mortar, of hardening in water, may be attributed to the magnesia or to the metallic oxides. Nevertheless, the Greek marble, which does not contain iron, produces a lime which hardens by itself, and that very speedily. Wishing to have positive facts respecting this question, we made mixtures of lime and magnesia in the different proportions, 0·04, 0·06, 0·08, 0·10, 0·15, 0·20. We had them calcined in a porcelain furnace; all these limes slacked with more or less difficulty. Being mixed, pounded, and worked up with siliceous sand, they produced mortars which acquired great hardness in water; the last, alone, appeared to become hard less easily than the others. It seems, then, from these results, that magnesia may be included among the substances which contribute to make lime harden in water.

We ought, to complete our experiments, to try clays combined with lime; but the results obtained by Smeaton in his analyses, and the positive consequences which he drew from them, prevented us. Smeaton says, in his great work on the Edystone Lighthouse, printed in 1759, it is a question which I leave to be decided by professed chemists and naturalists; wherefore, the presence of clay in the composition of lime-stone renders the lime proper for becoming hard in water, a property which lime, from pure calcareous stones, does not acquire. Clay added to common lime does not produce this effect. M. Vicat thought proper to examine, by the synthetic method, what was the influence of clay combined with lime, and his results confirmed those of Smeaton. The English engineer found that rich lime might hold as much as 0·20 of clay to 100 of lime. M. Vicat made the same experiment, and he found, in like manner as Smeaton, that the middling sorts of lime required 0·15, 0·10, or even 0·06 of clay, in order to possess hydraulic properties, that is to say, the property of becoming solid in water. When the dose was increased to 0·33 or 0·40, the lime obtained did not slack, but was easily pulverized, and produced sometimes, when diluted, a paste which became embodied under water very quickly.

M. Vicat does not mention what proportion of iron was in the clay which he employed, nor what were the respective proportions of the silex and alumen. He also does not say whether these clays contained magnesia, in which he imitates the silence of Smeaton. Nevertheless, the limes made with the stones or *lyas* of Aberthaw and of Watchet were magnesian, for they were not favourable to vegetation; and Smithson Tenant proved that magnesian lime was adverse to vegetation, and hindered or retarded it according to the proportion of magnesia which it contained, in the same manner as if magnesia were mixed with the soil.

Guyton points out ten places where they employ lime proper for making mortar, that hardens in water: Lena, in Sweden; Morex, in Switzerland; Misery, in Savoy; Aberthaw, in England; Brion, near Autun; Montelimart, in Dauphiny; Metz, in the department of Moselle; Saint Traille, in the department of Lot-and-Garonne; Senonches, in the department of the Seine and Loire; and Saint Catherine, near Rouen. Palladio has pointed out Padua, in Italy; Puymarin, near Bearn; Chaptal, in the Cévennes; and Grignon, near Bourbonne. Smeaton in Watchet, and in nine other parts of England. Saussure in the vicinity of Piget, in that of Planet, at Saint Gingoulph, in the valley of Chamouni, &c. &c. There are but few countries in which calcareous stones are not found proper for producing lime which has this property.

A long time after these experiments were made, and communicated each year to MM. the pupils of mines, M. Berthier, Engineer in Chief of Mines, and Professor of Docimacy at the Royal School of Mines, published in 1802, in the seventh volume of the Annals of Mines, page 497, and those that follow, analogous experiments, which we shall now transcribe literally.

The result of the great number of experiments which I am going to cite is, that silex alone, with lime, can form a combination eminently hydraulic, as the lime-stone of Senonches; and that magnesia by itself (as in the lime-stone of Paris), or mixed with the oxides of iron and of manganese (the lime-stone of Villefranche), could not produce a similar combination, and renders the lime meagre, without communicating to it the property of becoming solid under water. The synthetic experiments which I am about to report, go to confirm the consequences of the analysis, and prove at the same time, 1st, that alumen alone has no more efficacy than magnesia to render lime hydraulic; 2dly, that silex is an essential principle for these sorts of lime; 3dly, that the oxides of iron and of manganese, far from acting the important part that some persons have attributed to them, are, on the contrary, more frequently entirely passive.

Different mixtures of chalk and of common white sand having been baked in a lime-kiln, there was only obtained a meagre lime which was *not hydraulic*, and it was acknowledged that the twentieth part only of the sand was attacked and rendered soluble in the alkalies.

In substituting the sand of Aumont, prepared for the manufacture of porcelain of Sevres, that is to say, reduced to a very fine grain by mills, in place of common sand, the combination was better effected; but all the siliceous matter was not yet attacked, and there remained about a third of it which could not be dissolved in the alkalies.

These experiments confirm those made by MM. John and Vicat, namely, that to cause some earthy matters to combine themselves well with lime, it is necessary that they should be mixed with this substance in a state of imperceptible particles, and they let us see of what importance it is to effect these mixtures with all possible care, in order to obtain good artificial hydraulic lime.

There was calcined for an hour, in a platina crucible, at a temperature of about 50° of the pyrometer, a mixture of

Chalk....................	10	11·5 grams.
Gelatinous silex	1·5	

The substance slacked with a considerably strong heat in slightly swelling up: it formed a consistent paste with water, and at the end of two months' immersion, this paste had acquired sufficient firmness to resist the impression of the finger.

In the same manner was heated—

Chalk..................	10	14 grams.
Gelatinous silex	4	

This slacked with a weak heat, and without increasing its bulk, which is the characteristic of hydraulic lime. It was agitated with a great quantity of water in a corked bottle, and the part which did not dissolve was collected on the filter: it weighed 6·15 grams, and ought consequently to be composed of—

Chalk	0·35
Silex	0·65

Water, employed in a large quantity, tends then to decompose the different silicates with an excess of base, which can be obtained in the dry way, and to bring them to the state of neutral silicate, composed, theoretically, of

Chalk	0·3582
Silex	0·6418

But when this liquid is only used in very small quantities, it is absorbed and solidified for the greatest part by the combination, and the same decomposition does not take place; or rather, it is probable that there is formed a mixture, or perhaps a combination of the hydrate of lime and of a silicate, containing more lime than the neutral silicate, and of the water of crystallization.

There were calcined in a platina crucible, 10 grams of chalk, with quantities of hydrate of alumen, corresponding to 1·942 gram of alumen in one experiment, and to 2·36 grams in another experiment. The two mixtures slacked readily with a great heat, and they experienced a considerable puffing up; soft pastes were made of them, which were placed beneath water, but at the end of two months they had not acquired the least consistence. These pastes dissolved completely in muriatic acid, even when cold. It appears from this that lime and alumen combine in the dry way, but that the combination which is formed is totally decomposed by water.

Chalk, calcined with different proportions of oxide of iron, or of oxide of manganese, only produced limes without consistence, which acted like rich lime mixed with inert substances.

To be continued.

Remarks on Mr. Manton's Patent, for improvements in Shot.

By W——y.

Communicated by the Author.

The following remarks on Mr. Manton's patent shot having occurred to me on reading his specification in your Number for December last, I send them for insertion in the Repertory, should they be considered suitable for publication, considering that discussion on subjects of this nature to be serviceable both to the public and the patentees, since, if the invention has merit, and is really beneficial, it sooner brings it into notice; and if, on the contrary, it is defective, or that the patent cannot be maintained, expense in the further prosecution of an unprofitable speculation is spared to both parties.

It appears to me that the quantity of quicksilver to be used for very small shot should be greater than for the same weight of shot of a large size, on account of the surfaces of the small shot, which are to be coated with the quicksilver, being so much greater in proportion to its weight. Since if, for example, the large shot is twice the diameter of the small shot, one grain of it will be equal to four of the smaller sort in weight, while its surface will only be equal to that of two grains of the inferior size (from the well-known geometrical fact, that the surfaces of globes are directly as their diameters, while their solid contents are as the squares of those diameters); and hence it follows, that if one per cent. of quicksilver is sufficient for the large sized shot, two per cent. or double the quantity of it will be required for the shot of half the diameter.

It seems to me that the injury which game receives from shot depends more on the nature of the wounds given to it than on the quality of the shot, and that the common black lead coating could not hurt it more than the plain lead, or alloy, of which the shot is made, and which alone would come into contact with the game in the use of the shot of the patentee, since the heat caused by the exploding gunpowder in the discharge, could hardly fail to dissipate the whole of the mercurial coating of the shot before it could enter into the animals.

It might also be a question for medical men, whether the mercurial vapour caused in firing off this shot might not have unpleasant effects on some constitutions; while, on the other hand, as mercury, in most of its forms, is now prescribed by the faculty so generally in numerous different complaints, the use of the mercurial shot might, perhaps, from this very effect, prove salutary in many cases; and the sportsman might sometimes, perhaps, find his health improved by the mercurial vapour produced in firing off Manton's patent shot, as well as by the wholesome exercise, in the pure air of the country, which this sport, as it is called, causes, and the effect of which is the reverse of that of most medicines, being not less agreeable than it is conducive to the strength of the frame, and vigour of the constitution.

The above may give a hint for a new mode of prescription, and instead of directing a certain number of pills to be taken, a medical man may in future, perhaps, in his recipe, order from 20 to 60, or more, discharges to be fired off by the patient, from a fowling piece loaded with Manton's patent mercurial shot, as an agreeable mode of administering the medicine, and probably of peculiar efficacy in some complaints, from having the advantages of country air and of exercise combined with its salutary operations.

ACCOUNT OF NEW PATENTS.

Patent granted to John Linnell Bond, *of Newman-street, Architect, and* James Turner, *of Wells-street, Middlesex, Carpenter, for improvements in windows, casements, folding sashes, usually called French sashes, and doors, in making them less pervious to wind and rain.* Dated March 9, 1825.

The chief object of the patentee is to facilitate the raising up French sashes, principally with a view to let them down on a moulding or fillet that enters their lower parts, and prevents the ingress there of wind and rain, and the contrivances specified consist of different methods for this purpose.

In the first method the upper hinges of the sashes are of the sort used for doors that can be lifted out of their places, and the lower hinges consist of pintles, that descend into the cills of the windows, where they rest on the ends of horizontal balance levers, turning on pivots near their centres, to the other extremities of which weights are appended, so nearly counterbalancing the sashes as to cause but a small effort to be necessary to raise them. The bottoms of the sashes are hollowed out to fit a moulding that rises from the cill; or a thin piece or slip rises from the cill beneath them, and enters into a cavity cut for it in their lower edges.

In the second method a spiral or helical spring (shaped like a common cork-screw), surrounds each pintle at the bottom of the sashes, so as to keep them always elevated when not required to be let down. These springs easily yield to a small force pressing down the sashes, when over the slips or mouldings, and spring catches being placed at each side of the window frames, then enter into them, and prevent them from again rising until the catches are drawn back by the knobs or buttons, attached to their sides for that purpose. Where upper sashes are used with folding sashes, fitted as above described, they are to be fixed in the same plane with them, and a small space is to be left between them to allow of the rise of the lower sashes; which space is protected from the weather outside by a thin piece a little broader than it, fastened to the outside of the bottom of the upper sash, and at the inside it is covered by similar pieces, attached to the inside of the tops of the lower sashes.

In the third method for the purposes mentioned, the contrivance admits the folding sashes to be raised considerably higher than those described, which perhaps is intended for letting air in beneath them occasionally, while the upper sash, being in this method hung outside them, and balanced by the usual weights, so as to rise and fall in the common method, admit the passage of the air at the top likewise. The lower joints of the folding sashes in this plan are formed of pintles as before, but longer than the others, according to the rise of the sashes required; but the upper joints, called by the patentee "telescope hinges," are of a more complicated construction, and consist of a hollow tube attached to the top of the sash, which slides into another hollow tube, fastened above it to the upper part of the window frame; and to assist in raising up these sashes, pulleys are placed at the bottoms of the lower tubes inside, to which cords descend from the tops of the upper tubes, and after passing beneath them, ascend again to the tops of the upper tubes, from whence they pass out at the sides over other pulleys, to weights concealed in the window frames, in the usual manner.

Where the two folding sashes meet, the inside one, besides lapping over the edge of the other, has a moulding projecting from it, which enters into a corresponding cavity in that edge; and at the sides next the window frames they are secured by slips projecting from those frames, which enter into grooves made for them in the sides of the sashes, in the manner commonly practised for sashes of this description.

The plans of the patentees for raising the sashes, and for preventing the entrance of the wind and rain, are ingenious; and we believe would be effectual, if properly executed with good materials. The lapping joint, however, where the sashes meet, would be liable to get out of order if the wood of the sashes or window frames either shrunk or swelled, from one at least of which casualties it would be scarcely possible to preserve them. We also object to the use of any upper sashes whatsoever with folding sashes, as they would defeat their chief excellency, which consists in the facility they afford of cleaning their glass, without endangering the life of any person in going outside on the window stools for that purpose.

We have experienced the inconvenience of the common folding sashes in their admitting rain and wind, and on one occasion contrived to have it remedied by having a flat bar placed across edgewise, outside, on a level with the bottom of the frame of the upper panes, into the middle of which a thumb screw entered, after passing through the part of the sash frame where the two sashes met, and a second thumb screw being passed through the bottom of the sash into a nut in the cill in a similar manner; when both screws were turned tight the method proved very effectual.

But to any of the methods hitherto proposed for this purpose, we prefer that commonly practised in France, for its efficacy and simplicity, and should be surprised that it has never been adopted here, did we not know how much all English workmen prefer their own fancies to the imitation of even the best models. In the folding sashes in that country the joint where they meet is formed by a semi-cylindrical projection on the one, including nearly the whole of the thickness of the sash, that enters into a corresponding semi-cylindrical cavity in the edge of the other, which has the advantage of admitting a much greater tightness in closing the frames; for by the projecting part of one sash turning round in the hollow part of the other in closing the two, they keep in contact for a large portion of their surfaces, and admit of a great lateral pressure of the sashes against the window frames being used, for which their construction affords a species of mechanic power that increases rapidly as they approach near to their junction.

The method used for fastening these sashes is also very effectual; for this purpose a thick iron rod is fastened by rings, in which it turns, to the inside of the frame of the right hand sash, from top to bottom, at the part next the other sash; a handle, a few inches in length, projects at right angles from this iron rod, at a convenient height, being joined to it by a pivot, and from both the bottom and the top of the iron rod a claw or half hook projects at right angles, which, on closing the sashes, and turning the iron rod by the handle, enter into staples placed for them in the bottom and top of the window frames, and from the length of the handle admit of a leverage that aids the force used in closing the sashes; from the front of the opposite sash a catch projects, into which the handle is let down when turned round sufficiently, and by which alone the window is kept tight in the most effectual manner. On some of these sashes there are grooves at the hinge sides, into which slips or beads, in the sides of the window frames, enter; and some have small projections at their bottoms outside, to throw off the rain: but such is the tightness produced by the other arrangements, that this addition is seldom necessary. The same method is used for fastening folding doors, even of the largest dimensions; as we have witnessed in those of several of the French churches.

Patent granted to John Lindsay, *of the island of Herme, near Guernsey, Esq. for improvements in the construction and formation of horse and carriage-ways of streets, turnpike and other roads, and an improvement or addition to wheels to be used thereon.* Dated June 14, 1825.

The patentee proposes four methods for the improvement of roads. In the first a wheel-way is to be made in the middle of the road, of blocks of granite, broad enough to permit two wheels to pass each other on it with facility; and parallel to it, at the usual distance at which wheels are placed asunder in carriages, a wheel-way of half the breadth is to be constructed, of the same materials, at each side. The ground is to be well rammed where these wheel-ways are to be laid, and to be made as hard and durable as possible.

The two horse-ways between these three wheel-ways are to be paved with the common square paving stones, usual in the streets of London; but instead of being fixed in the same manner, they are to be placed with their broad ends downwards; and the angular interstices, which will be left between them by their being in this position, are to be filled up with wedge-shaped stones, grout or fine gravel being first placed in the cavities, sufficient, along with the stones, for the purpose; and the whole is then to be well rammed down. The wedge-shaped stones can easily be procured at the quarries, where the others are fashioned, from the chippings or pieces which are knocked off from them in the operation.

At each side of the road, at a due distance from the wheel-ways, a row of blocks of granite is to be laid, and to be hollowed in the middle, to form gutters for the conveyance of the surface water to the sewers; and the intervals between these gutters and the wheel-ways are to be paved in the same manner as the horse-ways.

In the second method the wheel-ways and gutters are to be formed as in the first method; but the horse-ways, and other intervals between them, instead of being paved, are to be laid with broken granite, or other hard stone, of a proper size, and in beds of due thickness for the purpose; and for greater security, the patentee recommends that before these beds of broken stone are put down, large rough stones be first laid, with their broadsides downwards, for a foundation to the horse-ways.

In the third method a road is to be prepared as in the second method, but with one of its side wheel-ways as broad as that in the middle; and then, at the same interval from this latter as is between the other wheel-ways, an iron rail-way, of a triangular section, an inch and a half in thickness, and in pieces ten feet long, is to be laid on a row of blocks of granite. Each end of these iron pieces is to be bent downwards, and let into cavities cut for them in the granite blocks, where they are to be fastened by having melted lead poured in to fill up the intervals; and the ends of these bent parts being made somewhat thicker than the rest, and the holes for them being undercut, or enlarged below, the lead will more effectually keep them in a firm unchanged position.

The wheels which are to run on these rails are to have angular grooves formed on the faces of their rims, a little wider than the rails, so as to run on them with facility; and the rail being only at one side, the wheels at the other sides of the carriages are of course to be made plain, in the usual manner.

In the fourth method the road is to be prepared as in the third method, in all other respects except that, in place of the triangular rail, cogged bars, about two inches broad, are to be laid on the granite blocks, and to be fastened to them in the same manner as the rails. When locomotive steam-carriages are used on this road, they are to have wheels at one side, formed with cogs or teeth all round, to correspond with the cogs on the bars, the wheels at the other side being of the usual form; but at each side of the cogged wheels there are likewise to be fixed flanches or flat rings, projecting sufficiently beyond the cogs to run on the granite blocks, and prevent any part of the weight with which the carriages are loaded from resting on the cogs, by which means their action in impelling the carriages will be much less impeded by friction. The wheels of common carriages may be also made to run on the same track, by being formed with projecting flanches alone, without having any cogs, or by having grooves cut in the middle of their rims, sufficiently deep to admit the teeth of the cogged bars to lie within them, while the load is sustained by the parts beyond the grooves.

Some of the methods for making roads, directed by the patentee, will be observed to be somewhat similar to those for which Mr. Parkins obtained a patent in March, 1825, an account of which is given in our last Number, page 193; but there are also several particulars in them which are not touched on by the specification of that patent.

We cannot see any great use in having a plain rail-road to sustain one side of the carriage, while the wheels at the other side run on a pavement; and object to the triangular form of the rail, as being peculiarly liable to injure the wheel made as directed to run on it, and to impede its motion by lateral friction, particularly after the wheel is some time in use, and worn down so as to come into a more close contact with this rail.

The method of fastening the ends of the rails by lead could not be very durable, as the vibrations of the rails, caused by the carriages, would not fail to make the lead yield to them before long, so as to become loose.

The plan of supporting the cogged wheels by flanches would be good if an iron way was prepared for these flanches to run on; but by running on the granite blocks, as proposed, we think they would soon wear channels in them sufficiently deep to defeat the very purpose for which these flanches were intended.

Patent granted to Charles Mercy, *of Edwards' Buildings, Stoke Newington, Middlesex, Gentleman, for improvements in propelling vessels.* Dated September 8, 1825.

In Mr. Mercy's method of propelling vessels, an axle is to be fixed horizontally across the vessel, either below or above the deck, the ends of which are to project beyond the sides; and from each of those ends one pair or more of flat radii, or arms, are to descend into the water in the plane of the axle, and at right angles to it; and across the bottom of these arms one or more paddles or flat boards are to be suspended by pivots, and are to be so regulated by stops attached to the arms, that they can open from the arms at one side to a rectangular position with them; while in the other direction they cannot pass beyond them. These paddles are also to be furnished with projecting rims at the upper edges and sides, which the patentee thinks will make them act more effectually on the water.

Within the vessel a lever or arm is to project from the middle of the axle, in a horizontal direction, to the further end of which is to be applied the power, which is to work it up and down, or the parts which are to form a communication with that power; which may be that supplied by a steam-engine, or any other convenient force, including the manual power of men.

The up and down motion of the lever will cause the arms and paddles to have a back and forwards, or alternately reversed motion through the water; and the paddles opening in one direction so as to present their edges only to the water, while in the other direction their flat sides or largest surfaces will be opposed to it, the vessel will consequently be impelled in a course contrary to that in which the paddles are moved, when in the latter state.

The arms or radii are to be placed with their flat sides at right angles to the plane of the axle, in order that they may be less impeded in their motion by the water; and in large vessels a third arm or radius may be placed in the middle between each pair, to give more support to the paddles, which in this case will be double the number of those used with arms placed in pairs. In the drawing belonging to this specification two pair of arms are represented at each end of the axle, and each pair is furnished with two moveable paddles; but a greater number of pairs of arms may be used if thought proper.

The patentee also mentions a method of fixing the axle at the bow of the vessel, at each side of the keel, and attaching its ends to brackets fastened to the bow. In this case the axle is to be moved by arms projecting from it horizontally at each end; from which arms bars are to ascend, to form a communication with the moving power. A slight sketch is also given of a break-water to be used at the bow with this latter apparatus, which appears to consist merely of two curved planks; but no particular description is given of it, or of its mode of application.

Of this method of impelling vessels we shall only observe, that we believe it to be decidedly inferior to the common method of moving them by revolving wheels, on account of the resistance, which the arms or radii and the edges of the paddles must make in being moved against the course of the vessel, being in it so much greater than that which the revolving radii make in any part of their revolutions.

The method of fixing the apparatus of the patentee at the bow, at each side of the keel, is still more objectionable than the other, from being liable to cause more resistance, and impeding the vessel in other respects so much, that it seems evident to us, from the patentee having proposed it, that he can have had little or no experience of the nature of vessels, or ever have gone a single voyage in one in which weather, of even moderate roughness, was encountered.

Patent granted to PHILIP CHELL, *of Earl's Court, Kensington, Esq. for improvements in machinery for drawing, roving, and spinning hemp, flax, and waste silk.* Dated February 18, 1823.

MACHINERY for spinning cotton by mill-work being so much more generally known than that for spinning flax, and other articles of more extended fibres, it will probably convey a tolerably correct idea of Mr. Chell's machines to state, that they are constructed on the same principles as those of the former for similar uses, with the variations necessary for the different length of the staple.

The drawing machine has a feeding cloth, similar to that used in engines for carding cotton, going over revolving rollers horizontally, on which the flax, being spread, is brought by the motion of the cloth within reach of a pair of guiding rollers, from which it is passed to a pair of retaining rollers, from whence it is pulled forwards by a pair of drawing rollers, that by turning round faster than the others, draw it out into a band or sliver, much more narrow than that first laid on the cloth, and deposit it in coils in a long narrow tin vessel or can, placed on the ground for its reception.

The rollers in this and the other machines for spinning flax are much thicker and longer than those used for cotton; the lower drawing and retaining rollers are made of metal, grooved on the surface lengthways in the usual manner; but those which lie above them, where they are pressed down by weights attached to their axles, are of a peculiar construction, and are each made by disks of thick leather, perforated at their centres, and run on an axle in sufficient numbers; and screws being previously made near the ends of the axles, these leather disks are then pressed close together by nuts, turned on the screws against metal washers, that are placed between them and the disks. The whole roller, thus composed, is then brought to a lathe, and turned evenly to the diameter required; after which it is left to soak in drying linseed oil, and dried, which coats it with a water-proof varnish.

The construction of these rollers constitutes one of the improvements claimed by the patentee. Another improvement, also claimed, is effected by having the puppets, or supports, which sustain the retaining rollers, placed on parallel horizontal bars, along which they may be moved closer to or further from the drawing rollers, as may be required for the more exact adjustment of their distance from them, to the degree which is most suitable to the length of the fibres of the flax, and they are there retained in their places by screws, properly disposed for the purpose.

A third improvement claimed by the patentee consists in a broad endless belt or strap, revolving horizontally on rollers placed at each end, in the same manner as the feeding cloth, which belt is placed to sustain the slivers where they would be likely to fall down in the intervals between the pairs of rollers, from the distance which these require to be placed asunder on account of the length of the staple of the flax. One of these endless belts may also be required between the feeding cloth and the retaining rollers, on account of the space necessary for shifting the latter on the adjusting bars not admitting of their being placed close to the guiding rollers.

Beyond the drawing rollers another pair of rollers are sustained, a little lower down, by brackets, which may be called the delivering rollers, as their office is to deliver the sliver into the can, after taking it from the drawing rollers. There is also another roller, of a smaller size, placed close behind the upper drawing roller, and which revolves somewhat quicker than it in a contrary direction, whose office is to smooth down the fibres of the flax, which the operation of drawing might cause to start out from the rest. This smoothing roller forms the fourth improvement claimed by the patentee.

The communication between this drawing machine and the mill machinery is made by an endless strap, which turns the lower drawing rollers, from which the proper motion is conveyed to the other rollers by similar straps or bands, going over wheels, or grooved pulleys, of sizes suited to the velocity of motion required for each, except the lower retaining roller, to which the motion is given by a mitred pinion on the lower drawing roller, which works in a similar pinion on a square horizontal bar, that runs along the top of the frame, on a level with the axes of the two lower rollers, and which has on it a second pinion, with a square aperture in its centre, that enables it to be moved along this square bar to suit the adjustment of the lower retaining roller, which roller this pinion turns by acting on a mitred wheel attached to its axis, of dimensions properly proportioned to those of the other mitred pinions, to cause it to turn round so much more slowly than the drawing roller as the nature of the work requires.

From the drawing frame the cans, as they are filled with coiled slivers, or bands of flax, are brought to the roving machine, where five or six of them being placed at the further end, the slivers from them are brought between pairs of retaining rollers, and from thence are drawn out, by drawing rollers, to a suitable fineness for the spinning frame. The rollers of the roving machine are turned in a similar way to those of the drawing machine, and are made in the same manner; and this machine has also endless belts to bear up the slivers between the pairs of rollers, and adjusting bars for regulating their distances, like those described. Two or more sets of these rollers may be placed in the same frame, by which so many rovings may be made in it at the same time. The use of thus combining several slivers in this machine is to make the rovings more perfectly even, by the fullnesses of one sliver falling in with the weak parts of another, which takes place in the operation.

The rovings are from this machine brought to the spinning machine, where they are first drawn out again by retaining and drawing rollers, constructed and moved in the same manner as those described, and furnished also with adjusting bars, and with endless belts for bearing up the materials; but as the rovings are much narrower than the slivers, these belts for them are proportionally reduced in breadth, and for the same reason the lower metal rollers are formed with several bosses on them, like those used in cotton spinning, each boss being appropriated to its respective roving. The upper rollers are made with two bosses to each, and have a weight suspended in the space between them. After passing the rollers, the material is spun on whirls similar to those used for cotton, but of a larger size, the bobbins of which are raised or lowered in a manner similar to those of the others, by a heart or eccentric wheel, to make them take up the thread evenly. In this machine, besides the parts mentioned, there is also a pair of rollers for each roving, which take up the rovings in the first instance; beneath which, troughs holding water are placed, in which the bottoms of the lower rollers turn, which bring up moisture sufficient to wet the rovings so as to produce the same smoothness in the thread as is produced in that spun by hand, by a similar operation, as well as to make the fibres draw out with more facility.

Lastly, the patentee mentions that this spinning machine may be converted into one for mule spinning, by adding a drawing frame to it, such as is used in spinning mules, with suitable spindles, in place of the whirls and bobbins. This addition of the mule-drawing-frame to the other machinery of the spinning frame, or of the latter to mule frames, constitutes the fifth and last improvement which the patentee claims as his sole invention. The method of changing the spinning frames into mule frames is not detailed in any particular manner, the patentee supposing that a general statement of it would be sufficient. The same machinery directed to be used for flax may also be employed for the other materials mentioned in the title.

Patent granted to PHILIP CHELL, *Esq. for improvements, &c. as in the preceding Patent.* Dated October 14, 1824.

THE specification of this patent may be considered as an enlargement of that last described, extending it in some points, and making certain additions to the machinery, which we shall mention, but in all other respects is the same.

In the specification of the first patent the degree of speed with which the drawing rollers turned more than the retaining rollers was particularized; but in that of the second patent that point is made unlimited, and left to depend on the judgment and experience of the constructor of the machinery.

In the first, also, the drawing and retaining rollers were directed to be arranged in pairs. In the present specification it is stated that they may be disposed in groups of three, five, or more, as well as in pairs; those of three having two lower rollers and one upper one, and those of five, three lower rollers and two upper ones; the upper ones being placed so, in those larger groups, that each of them shall be in contact with two of the lower rollers.

Thirdly, the guiding rollers, which were placed at the entrance of the former machines, are directed in those of the second patent to be removed, and other additional rollers to be placed in the intervals between the retaining rollers and the drawing rollers.

Fourthly, the slivers in the drawing frames of this last patent are delivered into the cans over large revolving drums.

And, lastly, it is stated, that the use of cans with the machinery may be dispensed with, or employed, according to the preference of the manufacturer.

We have been induced to give the above account of these two last patents, in consequence of having been informed that the inventions possess considerable merit, and that they offer advantages to the manufacturer greater than has been hitherto supposed they afford. The arrangement for regulating the distance of the retaining rollers from the drawing rollers, mentioned in the specification, which gives a power, of course, of placing them closer together than usual, as well as further asunder, in conjunction with the method of previously wetting the rovings before they are spun, have been particularly recommended to our notice, not only for the above reasons, but from an opinion that they, in a great measure, anticipate some material points claimed by individuals who have obtained patents for similar inventions since the date of those obtained by Mr. Chell.

Patent granted to JOHN BURRIDGE, *of Nelson-square, Blackfriars Road, Merchant, for improvements in bricks, stones, or other materials, for the better ventilation of houses and other buildings.* Dated June 9, 1825.

THE object of the patentee is to admit air to the parts of the extremities of rafters that are built up in walls, which will, he thinks, be sufficient to prevent the dry rot, by which so many floors and other parts of houses have been destroyed. This he effects by the use of bricks or stones, so formed as to leave cavities between them and the ends of the rafters, beside which they are placed in buildings; and which bricks, &c. may also be made to form channels or passages from thence through the walls to the external air, by arranging them properly together, or by using them in conjunction with common bricks.

The patentee gives representations, in the drawings which accompany his specification, of bricks prepared for these purposes in various manners. The first sort have square grooves cut at the angles at each end at one side; a second sort have the angles bevelled off at the same place; a third have the angles bevelled off at the sides as well as the ends; in a fourth sort a semicylindrical groove is made, from end to end, at one side; in a fifth kind two semicylindrical grooves are made, at equal distances from each other, and from the ends across the brick; and a sixth sort has only one groove of this kind across the middle of its surface; and in some of these the grooves are made to slope somewhat more towards the opposite side of the brick at one side than at the other, in order that, when these bricks are placed at the outside of walls, at the ends of the channels, the parts so sloped may permit any rain water, which may be blown into them by the wind, to run off again with more facility.

All these bricks are to be formed in the manner described, at the time when they are moulded, which the patentee states may be easily done, by properly disposing pieces of wood or of metal within the moulds, shaped so as to produce the cavities required in the bricks.

It is easy to conceive how these bricks thus grooved or bevelled at the angles, or those channelled lengthways or across, may leave cavities continued in any direction, when built up with common bricks, and how the size of these cavities or passages may be increased, by placing two of the bricks so that their grooves may correspond; and also how those which are grooved or bevelled at the angles may be disposed so that a still larger passage may be produced by placing four of them in contact; and views of these different arrangements of the bricks are given in the drawings.

Stones may be also cut in shapes, similar to those described; but the patentee confines his descriptions principally to bricks, as being sufficient to direct the shape of other materials used in building. He has also given a figure of part of a wall, having bricks of the foregoing description, so disposed round the extremity of a rafter, built up in it, as to convey air all about it at every side, and leave a free communication from thence to the outside of the building.

Much has been written on dry rot, and various preventives have been proposed against it, several of which we think would be very useful, while others would have but little efficacy. This destructive malady, if we may so call it, seems evidently to originate in dampness; whether this proceeds from the timber itself being used too soon after being imported, or cut down, or being felled when it contains too much sap, or is occasioned by mortar mixed up with water holding deliquescent salts, or by stones attractive of moisture being used in the building, or by the situation of the building being in a low marshy soil, or such as to be exposed to damp air from other causes, or by the dampness arising from any two or more of these causes combined. Some have attributed the dry rot to the fungus or lichen which generally grows on timber affected by it; but though this accelerates the decay, it seems evidently to be secondary to the rot, and to proceed from the seeds of this plant finding, in the decayed timber, a situation well suited for their vegetation.

From this view it is evident, when the timber can be kept dry by the admission of air, that ventilation will prevent this evil, and that the plans of the patentee would be effectual when they could be made to produce this effect; but we are doubtful whether, even in this case, he would derive much benefit from his patent, as there could be little difficulty in arranging common bricks so as to make passages through the walls to the ends of the rafters, and round about them, similar to those produced by the bricks, or other materials, of the shapes described, for which this patent has been obtained.

Charring timber externally, where it can be used, is an old and powerful means to prevent rot of any kind; and we think that the use of a strong solution of alum would also be found in many cases an effectual preventive, when applied to timber previously well dried, so as both to soak into it, and form a coat on its outside, this salt being a strong antiseptic of the efflorescent species, which is the reverse of being attractive of moisture, and, from holding an excess of sulphuric acid, being likely to resist the growth of any fungus or lichen. We understand that copperas has also been tried for the same purpose successfully.

REVIEW.

Transactions of the Society for the Encouragement of Arts, &c. Vol. XLIII.

The Annual Volume of this Society having just appeared, we have thought it desirable to give a short account of its contents, for the immediate gratification of our readers; and shall, agreeably to our accustomed practice, insert, at length, the most interesting of the articles in our future numbers, as opportunity may suit.

The first article in this volume is an account of the methods used by Mr. Ralph Creyke, jun. in bringing 429 acres of unprofitable peat moss to a state fit for agriculture by warping, so as to produce a rent of 35*s.* per acre. The term *warping* is applied to the process used on lands below the level of a tide river, of letting the water from it run over them, and after it has deposited its mud, causing it to return back into the river. The present is probably the most extensive improvement of this sort ever attempted, comprising altogether 1600 acres, of which, besides the 429 for which the Society gave a premium, 500 more were last March in a state of preparation for oats and grass, and all the more expensive parts of the works necessary for completing the remainder entirely finished. The average depth of the alluvial soil deposited in this ground was 3 feet, which is at least double the usual quantity, while the time occupied in the process was less by many months than that commonly employed.—The next article relates to the planting 172 acres of moorland with forest trees, by Col. James Wilson.—The third article is a description by Messrs. Cawley and Staines, of a method of raising seed from the grass employed in Connecticut, as a material for fine plat.—And the fourth contains useful information from Mr. W. Salisbury, on the materials employed in Tuscany for the same purpose. These two last articles are of the greater importance, as the making of fine plat affords a means of employing usefully the female members of families, without exposing them to the evils which are almost inseparable from most other manufactures, the work of which obliges them to congregate in large numbers.—The fifth article relates to a medal given to George Whitworth, Esq. for an improved variety of ray grass, the culture of which promises to be very beneficial.

Under the head of CHEMISTRY is comprised six articles, which certainly have considerable merit:—1st, The description of an apparatus contrived by Mr. John Roberts, for enabling persons to breathe in thick smoke, or in air loaded with vapours; which, though not so perfect as that for which Mr. Dean obtained a patent several months previously (an account of which is given at p. 61 of our first volume), or applicable in such dangerous situations, is, however, of very great utility, and, from its greater cheapness, and more convenient portability, will probably be adopted in more numerous instances.—2dly, An account of melting pots for iron and brass, made of Stourbridge clay and coke, by Mr. L. Anstey, which are found to possess very valuable qualities.—3dly, A description, by Mr. Wm. Sturgeon, of an electro magnetic apparatus, of a much cheaper and more effectual construction than any before employed, by which the means of making experiments on this very curious method of effecting rotary motions of weak powers, will be much facilitated.—4thly, On the preservation of lime juice, by Capt. T. M. Bagnold; the method used for which being the well-known process of Mr. Appert, has no novelty; but the paper deserves notice for the details, observations, and information, that it contains.—5thly, A simple and effectual method of etching on and cleaning alabaster by the action of rain water, by Mr. H. Moore.—And 6thly, a report on an analysis of British opium, which proved that it contained nearly one per cent. (0·714) more than the Turkey opium of morphia, on which substance the properties of this drug, for the most part, depend; the first yielding 43 grains from 700 grains of the opium, and the latter 48.

In POLITE ARTS are two papers which contain very useful information on the subjects to which they relate the first by Mr. Edward Turrel, on the mode of preparing etching ground for engravers, or the composition which they employ for covering the parts of their plates on which the aquafortis is not intended to act; and the second paper by Mr. William Savage, on his improvements in block printing, in imitation of coloured drawings.

Under the head of MANUFACTURES there is given an account of eight small premiums which were granted for hats and bonnets made of British grasses (chiefly of the crested dog's tail); and of five more premiums given for similar articles, made of the straw of spring wheat.—A short description of a bonnet, sent in by Mrs. Lowry, of Exeter, made of double wheat straw, which shows the polished surface of the straw at both sides.—And an account of specimens of sheeting, and twilled drill for trowsers, made from New Zealand flax, under the direction of Mr. R. Jones, Master of St. George's Workhouse, Little Chelsea. The qualities of the New Zealand flax, of which these last articles were made, has been known in this country upwards of fifty years; and yet it is only at the present day a few feeble efforts are made to work it, though it appears that neither its culture or its preparation is attended with any great difficulty. It is, however, more for sail cloth and cordage that the extraordinary strength of its fibres will make it valuable, than for webs of a lighter fabric, though certainly the specimens were of that species of them, wherein strength is most required.

In MECHANICS there are eighteen articles. The first is a description of a bevelled plane iron, by Mr. C. W. Williamson, the advantage of which we are of opinion requires confirmation, as we have strong reasons for thinking it has been tried more than once before.—The second is the description of a wedge for sawyers' use, that expands by springs, by Mr. T. Griffiths, which we apprehend may be found useful for light work, or in sawing out thin boards.—The third is a valuable communication from Mr. C. Varley, on a method of copying screws by means of the lathe, adopted by his late uncle, Mr. S. Varley.—The fourth is an account of an improved method of barrowing out soil, or removing it to a higher elevation, by Mr. D. Matthews, which deserves universal adoption, from its superseding a method before in use for the same purpose, which exposed labourers to great risk of the most dangerous fractures, or instant death.—The fifth is a description of a folding chair invented by Mr. J. P. Hubbard, which we suspect to be an old acquaintance.—The sixth describes an apparatus to assist a weak knee joint, by W. Brockedon, Esq. that appears to have given great relief where it has been tried.—The seventh is a description of a forceps, with three arms, to be used in lithotomy, contrived by Mr. Francis Cluley, of Sheffield, that seems to have considerable advantages over the forceps before used in that operation.—The eighth is an interesting account, by Capt. M. E. Bagnold, of the process employed at Bombay of making twisted gun barrels and sword blades, in imitation of those made at Damascus.—The ninth is a communication from Capt. Dickinson, R N. on a mode of applying percussion powder to the discharge of ships' guns; respecting which we have some doubt whether the flame of the percussion powder would in all cases reach the priming through the long drill, directed in this method, which drill in a large gun, whose breech is necessarily very thick, would exceed six inches in length.—The tenth is an account of a safety steam valve, by Mr. C. Sockl, of which we shall remark that it appears to us that no metal plate could long endure the frequent bending, which that which constitutes the peculiar feature of this valve must encounter, without cracking so as to let the steam be transmitted.—The eleventh is the description of a secret lock, by Mr. Walter Friend, which would be more perfect if it did not require to be taken to pieces whenever it is desired to change the secret coincidence of the parts on which its being opened depends.—The twelfth describes an improved method, by Mr. John Cow, of adapting a ship's launch to taking up and laying down anchors, and landing and shipping artillery, which it is stated has been found extremely serviceable, and which appears to us only to require a small addition to the trunks or tubes through which the ropes pass, to prevent the water from flowing over their tops into the boat, to render it unobjectionable. Considering the many lives which have been lost by the upsetting of launches in taking up anchors, we apprehend that it would be an act of humanity to have all boats intended for this purpose fitted up so as not to sink when the water runs over their gunnels, which some of the simpler plans published for preparing life-boats show, would neither be difficult nor expensive.—The thirteenth describes Mr. Elisha Pechey's forcing pump, which contains no novelty, or any thing else that we can perceive to give it the least superiority over one of the common construction; more especially, as the curvature of the working barrel, copied from Mr. Aust's pump, can be proved to render this more liable to unequal abrasure and derangement than a straight upright cylinder of the common form.—The fourteenth is a paper from Mr. Joseph Clement, describing a stand for drawing boards on a large scale, which appears to have answered its design very effectually. Where a stand of this kind cannot be procured without difficulty, we would recommend a common easel, or stand used by limners, to be tried as a substitute. Large drawing boards themselves require an improved construction to render them less liable to warping and twisting; and considering the proneness of all wood to change its form from hygrometric causes, it is very probable that slabs of stone would be preferable for the purpose to any framings of the usual materials. —The fifteenth describes an instrument made by Mr. W. Hardy, which notes the six hundredth part of a second of time, that has been found very serviceable in ascertaining the flight of projectiles for experiments made with artillery, and which might be used for determining distances of places on the same principle.—The sixteenth is an account of improvements, by Mr. J. Aitkin, on the striking part of a *quarter* clock, or one that strikes the quarters of hours, of which we doubt not the good performance; but from the plates of it, inserted at the end of the volume, should have imagined that simplicity of construction would have been the last point thought of for its commendation, instead of being put forward, as it is, as its primary excellence.—The seventeenth article contains numerous particulars relative to a portable rope bridge of suspension, by Colin Shakespear, Esq. which is stated to have been of great service in the East Indies as a temporary bridge, and seems likely to be extremely useful in military expeditions, particularly in countries intersected by numerous small rivers. The dividing each of the principal bearing ropes into several lengths, adopted in it, does not, however, appear to us to be attended with any benefit which can compensate for the multiplicity of clamps, and other iron work which it occasions, and seems to us, by its complication, to diminish needlessly the chief advantages of its construction.—The eighteenth is a very excellent communication by Mr. Alfred Ainger, on making centering for large arches, which deserves the attention of all architects who may be likely to be concerned in works where centering of this kind is necessary.

The Papers in Colonies and Trade are,—1st, An account of a plantation of clove and cinnamon trees, by M. Le Cadre, on the island of Trinidad, which proves that both these articles, particularly the first, may be obtained from the West India Islands, of an excellent quality, as well as from the more distant settlements in the Eastern hemisphere.—2dly, A statement relative to five tons of extract of Mimosa bark, made at Van Dieman's Land, and sent over to this country by Messrs. Petchey and Wood, which is superior to some before imported. This extract has been found very serviceable in tanning, and if used extensively, would certainly have the national advantage mentioned in the preface, of preventing the felling of oak timber in spring, which makes it so liable to subsequent decay.—3dly, A description of an apparatus for extracting stumps of trees, by J. Mackay, Esq. of Picton, in Nova Scotia, which has proved of great advantage in that country, and would also be so in many other places where the climate accelerates the decay of the small roots of the stumps sufficiently, and rocky or clay subsoil did not too much obstruct their eradication.

In an APPENDIX is the description of part of Capt. Bagnold's steam culinary apparatus which was omitted in the last volume.—An account of some further improvements made by Mr. James Jones, in a kiln for drying corn, for which he had before received a premium from the Society.—A paper on the prevention of forgery, by Messrs. Perkins and Heath, with a beautiful specimen of a note, engraved on those principles, the efficacy of which appears so very convincing as to excite astonishment at the unyielding obstinacy of the Bank, in declining to adopt any of the various means which have been proposed to them for this purpose, and which have proved so serviceable to other concerns.—And a circumstantial and valuable communication, by the late Archibald Stephenson, Esq. on the rearing of silkworms, winding silk from the cocoons, and the cultivation of the mulberry tree, which paper has been long in the possession of the Society, though not before published, for which, however, no reason is assigned. This information was collected with a view to introduce the rearing of silkworms into England; but the habits of the peasantry, added to the nature of the climate, form, we fear, an insuperable obstacle to the production of silk in England, as a domestic manufacture, as practised in France and Italy, though very possible to be effected by individuals possessing capital, enterprise, and judgment. And the Society seem to be sensible of these difficulties, by confining their premiums for raising silk to the British colonies.—Lastly, the volume, which upon the whole we think more interesting than its immediate predecessors, concludes with a list of presents received by the Society in 1825; a catalogue of models and machines presented in that year; and numerous well executed engravings of figures, explanatory of the subjects of the several articles in the volume.

LIST OF NEW PATENTS.

James Fraser, Houndsditch, London, engineer, for an improved method of constructing capstans and windlasses.—Dated February 25, 1826.—(*Two months to enrol specification.*)

Benjamin Newmarch, Cheltenham, Gentleman, for certain inventions to preserve vessels and other bodies from the dangerous effects of external or internal violence on land or water, and other improvements connected with the same.—Dated February 25, 1826.—(*Six months.*)

The same, for a preparation to be used either in solution or otherwise, for preventing decay in timber or other substances, arising from dry rot or other causes.—Dated February 25, 1826.—(*Six months.*)

James Fraser, Houndsditch, London, engineer, for a new and improved method of distilling and rectifying spirits and strong waters.—Dated March 4, 1826.—(*Two months.*)

Robert Midgley, Horsforth, near Leeds, Gent. for a method, machinery, or apparatus, for conveying persons and goods over or across rivers or other waters, and over vallies or other places.—Dated March 4, 1826.—(*Six months.*)

George Anderton, Chickheaton, Yorkshire, worsted spinner, for improvements in the combing or dressing of wool and waste silk.—Dated March 4, 1826.—(*Two months.*)

James Neville, New Walk, Shad Thames, engineer, for a new and improved boiler or apparatus for generating steam with less expenditure of fuel.—Dated March 14, 1826.—(*Six months.*)

Nicholas Hogesippe Manicler, of Great Guildford Street, Southwark, chemist, for a new preparation of fatty substances, and the application thereof to the purposes of affording light.—Dated March 20, 1826.—(*Six months.*)

THE
REPERTORY
OF
PATENT INVENTIONS, &c.

No. XI. MAY, 1826.

Specification of the Patent granted to THOMAS HANCOCK, *of Goswell Mews, Goswell Street, in the county of Middlesex, Patent Cock Manufacturer, for a method of making or manufacturing an article which may be in many instances substituted for leather, and be applied to various other useful purposes.* Dated November 29, 1824.

TO all to whom these presents shall come, &c. &c. *Now know ye*, that in compliance with the said proviso, I, the said Thomas Hancock, do hereby describe and ascertain the nature of my said invention, and the manner in which the same is to be performed, as follows, (that is to say):—The nature of my invention consists in combining together the fibres or filaments of various matters, such as flax, hemp, cotton, wool, hair, or other matters of the like flexible nature, by saturating them in connection or in contact with each other with a liquid which, when partially evaporated, becomes a flexible and adhesive substance, such fibres being previously arranged or disposed as to shape and dimensions, according to the purpose to which they are afterwards to be applied, so as to produce a uniform combination of the fibres and the substance, or in such a manner as that every individual fibre may be so surrounded with the said substance, as that the whole of the fibres composing the mass, when united by the substance, may form a compound or article somewhat resembling leather; and which said compound substance or article may in many cases be substituted for leather more or less advantageously, namely, for harness, straps, belts, accoutrements, boots, shoes, flexible pipes, air tight bags, and a variety of other things which have heretofore been made of leather; and the said substance or article may also be applied to various other useful purposes, such as parts of wearing apparel, which it may be desirable to have waterproof, and which commonly are made of other substances than leather. The article may also be applied for the roofs of virandas, awnings, tent coverings, and to other similar purposes. I shall now proceed to describe the method of making the said article, and the manner in which my said invention is to be performed; and in order the more clearly to describe the same, I will premise that the choice of the particular kind of fibres to be used, and the manner of preparing the said fibres, will depend upon the use or purpose to which the article is to be applied when made. Many of the substances I have mentioned, such as hair, wool, cotton, flax, and others having short fibres or filaments, are capable of being carded in the same manner as is commonly practised in carding wool and cotton for making yarn or thread. I therefore employ the carding machine (a machine well known, and in common use, and therefore needing no further description), to card the aforesaid fibres; and those which are capable of being felted may have that operation performed. And by this means I am enabled to obtain a layer of fibres, of uniform thickness, and of any convenient dimensions as to length and width, I take one or more of such layers of fibres, according to the required thickness of the article when made, and spread it or them upon a flat board. When the thickness of the article to be made requires more than one of such layers of fibres, I spread them out upon a flat board as before-mentioned, layer upon layer, until the number is completed. I then sprinkle the whole with cold or warm water (but the latter answers best); at the same time I press the layers together until the whole becomes uniformly wetted. In this state they are placed between two flat boards or flat plates, of any suitable metal, and exposed to strong pressure in a screw or other press, or by passing the said boards and plates together with the layers of fibres between them through or between a pair of rollers. By this means the whole of the fibres become more uniformly wetted, and the superfluous water is expelled or got rid of. The said layers having been thus wetted, are now ready, or in a proper state to be saturated with the liquid, which forms the flexible and adhesive substance hereinbefore mentioned. At the time of applying the same it is in a liquid state, and I saturate the layer or layers of fibres therewith by first pouring a proper quantity of it upon the surface of the said layer or layers, and I spread the same over the said layer or layers with a smooth spatula, or other suitable instrument, made of wood or other proper material, and by gently pressing the said layer or layers of fibres with the spatula, or other suitable instrument, the liquid is made to sink into and mix with and pervade the whole mass of fibres throughout the said layer or layers. I also perform the said operation of saturating in a more convenient manner, by placing the said layer or layers of fibres in a shallow trough, with a flat and level bottom, and by this means a greater quantity of the said liquid may be poured over the layers, as the sides of the trough will prevent its running to waste, and the fibres are thus more easily saturated by dabbing or pressing them with the hand or a spatula. A trough may also be advantageously used for placing the layer or layers of fibres in when they are to be wetted with water, as before-described. When the layer or layers of fibres have been sufficiently saturated with the liquid, I place them upon a flat board, in an inclining position, and in order to squeeze or press out any excess of the liquid, I pass a wooden roller over the surface of the layer or layers of fibres, at the same time applying a sufficient force, by hand or otherwise, to the roller, to force or squeeze out the liquid. This operation may be carried on by exposing the layers to a strong mechanical pressure, if necessary. The process having been carried on so far, the layer or layers of fibres now require to be dried. I therefore now place the said layer or layers of fibres in a room heated to eighty or ninety degrees of temperature, and allow them to remain there till they are nearly dry, or until the liquid becomes viscous, glutinous, and adhesive. The layer or layers of fibres having been thus dried, I expose them again to a strong pressure, by which the whole of the fibres are brought into closer contact with each other, and with the interposed substance, so as that the said fibres are made to adhere firmly to each other. If on exposing the layer or layers of fibres to pressure for the first time, after being dried, I perceive that any water or fluid matter exudes or is driven out by the pressure, I conclude that the first drying has not been continued long enough. I therefore place the layer or layers of fibres in the warm room a second time, and afterwards subject the said layer or layers to a second pressure. It is in some cases requisite to give a smooth surface to the article, and this I effect by polishing the surfaces of the plates between which the dried layers are pressed for the last time. The liquid I use for the purpose hereinbefore mentioned is brought into this country, and said to be the juice obtained from certain trees which grow in several parts of South America, the East Indies, and other places abroad. It is stated in Mr. William Nicholson's Translation of Fourcroy's General System of Chemical Knowledge, that this juice is obtained in South America from a tree called the Hevœa. The juice or liquid I have made use of was obtained from South America, and from my own experience I find that the said juice or liquid, when exposed to the open air in the sun, or in a warm room, becomes inspissated or dried, and then forms a substance exactly resembling, and which I believe to be identically of the same nature, and to possess the same properties with the substance well known by the names of caoutchouc, or Indian rubber, or elastic gum, and it is employed abroad for that purpose. Its colour and consistence very much resemble cream. In manufacturing any article where the colour is not an object, I employ this liquid in its natural state, without any previous preparation excepting that of freeing it from ligneous or other substances, by straining it through a sieve or open cloth. But if the article is intended to be of a light or delicate colour, it is necessary to free the liquid from the colouring matter combined with it, and for this purpose I put it into a glass bottle or other vessel, of an appropriate size, and add to it three or four times its bulk of clean water. I then cork or stop the mouth of the bottle or vessel so as to prevent evaporation, and after well shaking the liquid and water together, I allow it to stand undisturbed till I perceive the whole of the water has subsided to the bottom of the vessel, which it does in a few hours, and leaves the liquid floating at the top. The vessel which I employ for this purpose has a hole through its side at or near the bottom, and through this hole (which is provided with a cork or stopper) I draw off the water after it has completely separated from the said liquid above. This operation of washing or cleansing the liquid I repeat as often as I find necessary for rendering it sufficiently clear and colourless. As the method of manufacturing the article intended to be employed as a substitute for leather, which I have hereinbefore described, applies only to the formation of pieces of uniform texture and strength in every direction, I will now proceed to describe the method I employ in manufacturing any article, such as a strap or band, or such as require the greatest strength in one direction only. In such cases I make use of longer fibres, as the long wools, hemp, flax, &c. and instead of subjecting the said fibres to the carding operation, I cause them to be combed or hackled, and thus lay the greatest number of the said fibres nearly parallel with each other. In the operation of combing wool or hackling flax, it necessarily happens that you obtain a quantity or bundle of long and short fibres, mixed together in such a manner as to cause the bundle to contain more fibres, and therefore to be thicker in the middle than at the ends, or, in other words, the bundle tapers off from the middle towards the ends. In order, therefore, to obtain a layer of such fibres of uniform thickness, of a proper length and width required for the strap I intend to make, and ultimately to produce a strap of uniform strength, or nearly so, throughout its length, I first make a wooden trough, of the required length and breadth, with a flat bottom. In this trough I place in succession small bundles of such fibres as are proper for the purpose, taking care that the end of each consecutive bundle shall be laid upon or over the middle of that which preceded it, and thus filling the trough from side to side, and from end to end, I obtain a uniform mixture or splicing of the fibres, one with another. The layer being thus completed, I proceed to wet it, saturate it with the liquid to dry, and press it in a similar manner to that hereinbefore described. But although straps and bands require the greatest strength in the direction of their length, I also find it necessary to strengthen them in the lateral direction, by interposing between the layers of longitudinal fibres several layers of shorter fibres, lying across the strap. If great stiffness, solidity, and firmness, be required in the article to be made, I saturate the layer or layers of fibres with the liquid, as hereinbefore described, and afterwards press it very lightly with the roller, in order that a considerable quantity of the substance may remain incorporated with the layer of fibres, because the comparative solidity, stiffness, and firmness of the article, will depend upon the quantity of the elastic and adhesive substance remaining in combination with the fibres, as well as upon the degree of pressure to which the layers are subjected when dried; and if, after saturation, a great portion of the liquid be pressed out, the softer and more flexible will be the article when finished; consequently, when I intend to manufacture an article to be substituted for the softer kinds of leather, I expose the layer of fibres, after being saturated with the liquid to a greater degree of pressure, so as to drive out a greater proportion of the liquid. In making an article of the kind last-mentioned, I find it convenient before I use the liquid to mix with it about one fourth of its bulk of water. After adding the water to the liquid, they must be shaken together until a uniform mixture is produced, and it must be used while in this state of mixture. From what I have hereinbefore stated, and from the nature of the process, any competent manufacturer will be led to make a proper choice of the fineness, coarseness, and kind of fibre to be used for the various kinds and qualities of the articles intended to be made. It is necessary for me to mention here, that when I make use of the liquid in a washed or purified state, I take care to place the layers of fibres to be saturated therewith in a trough, made of some of the whiter woods, such as sycamore or American pine, or such as will communicate no tinge or stain to the liquid or fibres. And I also use the same precaution in pressing out the superfluous quantity of liquid by effecting the pressure between boards of the same kind; and I have also to state that the liquid acts upon, or is acted upon, by iron, copper, and brass, and even tin in a slight degree; and that these metals communicate a stain or tinge, more or less, to the liquid in contact with them; but for pressing the layers of fibres after being saturated and dried, metal plates may safely be used, and are necessary to give a smooth or glossy surface. It will often happen, on account of the great variety of purposes to which the article may be applied, that it may or will require a combination of the fibres of several substances to be mixed together, and formed into one layer, or the combination of two or more layers, in which the fibres of one layer may be of a different substance from the fibres of another layer. For instance, in making the article as a fit substitute for leather harness, where it would be desirable to combine a neat smooth surface to great strength, I interpose one or more layers of flax or hemp between two layers of cotton; and other combinations may be made, according to the properties which it may be desired to give to the finished article, or as economy may dictate.

In witness whereof, &c. &c.

Specification of the Patent granted to John White, *the younger, and* Thomas Sowerby, *both of Bishop-Wearmouth, in the county of Durham, Merchants, for an improved air furnace, for the purpose of melting or fusing metallic substances.* Dated November 6, 1826.

WITH AN ENGRAVING.

TO all to whom these presents shall come, &c. &c. *Now know ye*, that in compliance with the said proviso, we, the said John White and Thomas Sowerby, do hereby describe and ascertain the nature of our said invention, and in what manner the same is to be performed, reference being had unto the drawings hereunto annexed, (that is to say):—Our invention of an improved air furnace, for the purpose of melting or fusing metallic substances, consists in our so adapting it as to have the means of giving to the current or currents of air admitted by a flue or opening, or by flues or openings in the side or sides of the furnace, different directions through the fuel, as the heat is required to be applied; and of using coke or other fuel, with greater advantage than has hitherto been done, without the aid of a mechanical power, as used for the blast furnace or cupola. One example of our invention we shall give, as follows (that is to say):—

Fig. 1 (Pl. XI.) shows a ground plan of our improved air furnace, as adapted for melting pig or cast iron for foundry purposes, which operation has been usually performed by means of the common reverberatory furnace, or by a small blast furnace, otherwise called a cupola.

Fig. 2 represents a section of our improved air furnace.

Fig. 3 shows an elevation of the same furnace.

The preceding figures are drawn to the scale annexed thereto, and the same letters refer to the same parts in each figure. A B represents the upright or vertical part of the furnace: D D D the bottom or bed place, which is open into or communicates with a flue or chimney at E: C an opening from the furnace also, into or communicating with a flue or chimney: F the air flues, by which atmospheric air is admitted, of which there may be one or more: G a man-hole or opening for clearing out or preparing the bed place or flue: H H the main flue or chimney, the height of which is required to be about the same as for the common reverberatory furnace: *aa* a cast iron cover for the top of the furnace: *bb* a plate or damper for regulating the capacity of the flue: *cc* a plate or damper for the like purpose. The darts point out the direction of the currents. The furnace and bed place, D D D, being cleared and prepared, the cover *aa* is taken off, and the coke or fuel is put in at A, which is lighted at the air flue or flues, or other convenient opening, when the furnace has come to a sufficient degree of heat for melting, well known to any workman used with and competent to attend the reverberatory furnace or cupola, the man-hole or opening, G, being closed in the ordinary way of closing such openings in furnaces, by a loom cake or otherwise; then the metal to be melted and coke are put in alternately at A, in such way, quantities, and proportions, as they are generally done in the small blast furnace or cupola. The cover *aa*, which is taken off to put in the coke or metal, is replaced as soon as that is done. As the metal is melted, it is precipitated to the bottom or bed at D D D, where it is kept hot by a current of flame passing over it to the flue or chimney, in the direction of the dart BE, and whence it is drawn off for use at *o*. The foregoing example of the application of our improved air furnace will be sufficient to enable a workman to construct one for the purpose of melting or fusing other metallic substances; but the furnace may be either square, or round, or oval, or octagon, or any other form, retaining the power of giving to the current or currents of air admitted by a flue or opening, or by flues or openings in the side or sides of the furnace, different directions through the fuel, as the heat is required to be applied.

In witness whereof, &c, &c, &c.

OBSERVATIONS BY THE PATENTEES.

In the foregoing specification it is stated that the patent air furnace is applicable to various metallurgical purposes.

To enter into all the particular cases in which it may be advantageously adopted, and to illustrate them individually by example, would be a work more fit for a series than for one article in a periodical journal. Therefore, as an example has been already given of it as adapted for melting cast iron, the present observations are designed more particularly to show its advantages over the means now used for *that purpose*, than necessarily come within the limits of a specification. A reverberatory air furnace or a cupola (a small blast furnace), is generally used for melting pig or cast iron. That so little has heretofore been done towards bringing to perfection a more complete and economical furnace than either of them, is somewhat surprising. They are each very expensive, both as regards their original cost, and their subsequent operations. They are widely different in their principles, and reciprocally possess advantages over each other, whilst neither of them is adapted for all the purposes of a foundry furnace. Such being the case, a cheap and simple furnace, which combines all that is desirable in both, and is free from all that is objectionable in either, and which performs its operations at a considerably less cost, must be considered an important and useful invention. That the patent air furnace fully answers the above description will appear from the following comparisons of it with the reverberatory and the cupola respectively, than which we are persuaded further arguments will not be required to secure its adoption in the cast iron foundry.

The Patent Air Furnace and the Reverberatory Air Furnace compared.

Firstly,—The reverberatory is a large and expensive building. The patent furnace is a compact and cheap erection; it will generally be found not to occupy one-fourth as much ground as the former, and in its construction there is a much less proportion of expensive materials, no grate bars, and very little other iron work being required for it; neither need the chimney be lined to the top with fire bricks.

Secondly,—The reverberatory is supplied with air by natural means, without the aid of machinery; and so, also, is the patent furnace. But the quality of the air supplied to the fire in each is different. The air, on its way to the former, passes through the heated ash pit, and is thereby considerably rarefied. The air flues, by which atmospheric air is admitted to the patent furnace, are so constructed as to intercept, in a great measure, the radiation of heat, so that the air in the outer regions of the furnace suffers very little rarefaction, and is therefore the more fit for supporting combustion.

Thirdly,—There is a great difference in their consumption of fuel to melt a given quantity of metal. A small patent furnace melted at one time five tons of metal, for which it did not require one ton of coke. It would have required about five tons of good pit coal to have melted the same quantity in a reverberatory furnace. This is owing to the different way in which the metal is submitted to the action of heat in each (or in which the heat is applied in each).

Fourthly,—The metal melted in the reverberatory suffers materially in its quality. From the extended surface of melting and melted metal being exposed to the action of a passing flame, it is partially decarbonized, and is thus frequently rendered unfit for many kinds of castings. The metal in the bottom or well of the patent furnace is protected by a quantity of small coke resting on its surface, so that when run into goods, it is of very superior quality to the former.

Fifthly,—The ordinary waste of metal by the reverberatory furnace is considerable. It may be averaged at 10 per cent. of the whole weight put into the furnace. The waste by the patent furnace does not exceed that by the cupola, which will rarely be so much as 5 per cent. This difference is principally attributable to the same cause as the difference in quality produced by the two furnaces.

Sixthly,—The patent furnace melts more metal in a given time than the reverberatory. The furnace from which the drawings are made has melted from 16 to 18 cwt. in one hour.

Seventhly,—In using the reverberatory furnace, unless the furnace-man be unremitting in his attention to the fire, &c. much damage may be sustained by the metal being converted into what is sometimes termed scull iron, or into a useless malleable state. On the contrary, if the patent furnace be but regularly supplied with fuel as the ignited mass descends, as in the case of the cupola, its operations will be uniform.

Eighthly,—The reverberatory furnace is very expensive to keep in repair. The interior of the furnace and chimney are liable to considerable wear by the action of the flame. The flame of the coke used in the patent furnace extends but a short way, and is not so destructive in its quality. Besides which, there is a much less surface exposed to the injurious effects of the fire, and no iron grate bars to renew.

Ninthly,—The smoke and dense flame frequently issuing far above the top of the reverberatory chimney is truly terrific, as well as being very injurious, when situated in the middle of a town. Nor is it less dangerous and objectionable when on the sea coast. There is no such flame or smoke seen rising above the top of the chimney of the patent furnace.

The Patent Air Furnace and Cupola compared.

Firstly,—The cupola is supplied with air by mechanical means. It is consequently quite useless without its appropriate blowing machinery. The patent furnace, although it resembles the cupola both in its mode of action and results, is, nevertheless, *complete in itself*, requiring no blowing machinery, by reason of which its original cost is much less.

Secondly,—The cupola not only requires the appendages of blowing machinery, but there is also a mechanical power required to work it; sometimes steam-engine, or horse, or water power, is used. Hence, besides an additional expence for the steam-engine, horse, or water wheel, and intermediate machinery, &c. there is an immense weekly or annual charge entailed upon its operations for the production of the mechanical power. Nor is it less when manual labour is applied, which is sometimes done in small foundries. The patent furnace *requires neither steam-engine, water, nor animal power,* nor any machinery.

Thirdly,—The cupola is very costly to keep in repair. Its fabric, in contact with the fire, is fast destroyed, thus incurring a perpetual consumption of expensive materials; in addition to which there is also the wear and tear of machinery. The patent furnace is more durable, and has no machinery to be kept in repair.

Fourthly,—The operations of the cupola are necessarily liable to interruption by the failure of machinery, &c. From this disadvantage the patent furnace is alike exempt.

Fifthly,—The patent furnace is equally adapted for every situation where atmospheric air can but have access to it; whereas, it often happens, that the most convenient place for the cupola is the least convenient for its machinery, so that sometimes the condensed air has to be conducted to a great distance by means of cast iron pipes. At other times there is a difficulty in obtaining the mechanical power, for want of water, &c.

Sixthly,—Although the metal from the cupola is more suitable for many kinds of castings than that from the reverberatory furnace, having parted with less of its carbon in fusion than the latter, yet reverberatory metal is frequently preferred when great strength is required. The patent furnace will not only at all times produce metal of the same profitable quality as that from the cupola with the same materials, but it also retains the power of producing it of the same strong quality as that from the reverberatory furnace, by merely allowing a less proportion of coke to remain on the melted metal whilst in the furnace.

Seventhly,—The coke and metal are put into the patent furnace alternately, *stratum super stratum.* As it descends the metal is thus gradually brought in contact with the greatest heat that is excited in the furnace, as in the cupola. Yet it will generally be found that the patent furnace will do with a less proportion of fuel to metal than the cupola. This will be especially the case when a large quantity is melted at one time.

From the foregoing comparisons of the patent furnace with the reverberatory furnace and cupola, many of its great and important advantages as a melting furnace for cast iron will be readily deduced. Afraid of trespassing too far on the invaluable pages of the Repertory, we have avoided entering so fully into the subject as otherwise might have been desirable. Therefore, the further appropriations of the patent furnace must be the subject of future communications.

Specification of the Patent granted to CHARLES PHILLIPS, *of Upnor, in the parish of Findsbury, in the county of Kent, Esquire, for a certain improvement or improvements in the construction of a ship's compass.* Dated June 18, 1825.

WITH AN ENGRAVING.

TO all to whom these presents shall come, &c. &c. *Now know ye,* that in compliance with the said proviso, I, the said Charles Phillips, do hereby declare, that the nature of my said invention, and how the same may be performed, is herein set forth and explained, by the following description and drawings hereto annexed (that is to say):—Fig. 4 (Pl. XI.) represents a front elevation of one of my improved compasses, one side of the box or case in which it is fixed being removed that its peculiar construction may be seen more plainly. A is a hollow tube, forming a standard, to support the compass: B C is a spiral spring, which is contained within the tube or standard, and rests upon the moveable bearing *a*: *b b* are two handles attached to the bearing *a*, by which it, and the spring, C, may be elevated within the standard, A, and made to rest in either of the recesses seen at 1, 2, 3, 4: *c* is a groove or aperture pierced in the tube or standard A, and connected with the recesses 1, 2, 3, 4. A similar groove is formed on the opposite side of the standard, within which the other handle of the bearing, *a*, moves. Fig. 5 represents a vertical section through the centre of fig. 4.

A A is the hollow tube or standard, and B the compass: C shows the spiral spring resting upon the moveable bearing *a*: *d* is a moveable portion of the standard. This is cylindrical, and made to fit the internal bore of the tube A. A portion of the cylinder is reduced at *e*, in order to prevent friction, it being necessary that the part *d* should move up or down very freely within the tube A: *f* is a cap, fixed upon the standard, A, by a bayonet joint;

this cap prevents the spring, C, from forcing the cylinder, *d*, out of the tube A : *g* is the pivot that carries the compass card D; the lower end of the pivot has a spherical ball, as shown at *h*, which rests upon a surface of cornelian, agate, or any other hard stone, let into the top of the cylinder, as seen at *i*, and it is confined in that state by the cap E, the upper internal part of the cap being made hemispherical, so as to form a portion of a cup to cover the ball *h*, and permit it to move universally.

The lower internal part of the cap, E, screws on the upper end of the standard *d*; the lower portion of the pivot *g* is made slightly conical, and fits in a hole formed in the crop bars, F F, where it is retained by friction.

Fig. 4, G, is a ring of lead, circumscribing the case of the compass B : H is a guide, attached to the compass by sockets and screws at *l l*. This guide goes through the leaden ring, and also through the brass piece, I I, let into the ring. A similar guide, and also the other parts described, are attached to the case on the opposite side. K K are two handles, fastened to the leaden ring G, by which means it can be lifted up or down at pleasure, and it may be retained at any convenient height by the palls, L L, dropping into the notches of the racks, *m m*, which racks are screwed to the sides of the case B.

Fig. 6 represents an elevation of the upper and moveable part of the standard *d*, detached from the tube in which it moves. This figure is drawn of the real size and form, as it is made for compasses of the largest dimensions; and the cap, E, is shown in section, in order that the spherical ball, N, resting upon its agate bearing, *i*, may be better seen.

Fig. 7 shows a plan of the ring G : the recesses, *n n*, receive the racks, *m m*, and the grooves or recesses, *o o*, permit the guides, B, fig. 4, to pass freely through them.

M, fig. 5, represents a side view of the lubber's point, suspended and moving upon the centre, N. The centre, N, is placed between two guides, and may be raised or

Fig. 4.

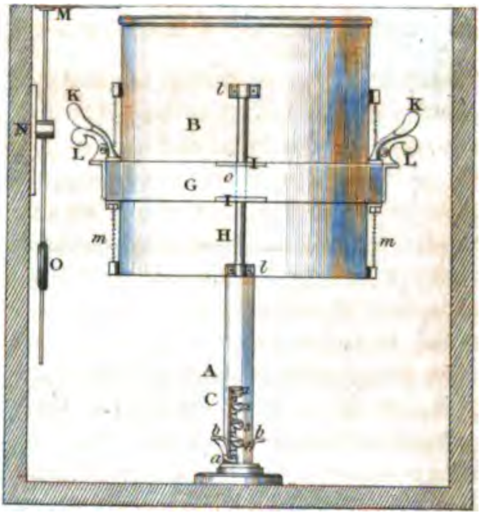


Fig. 5.

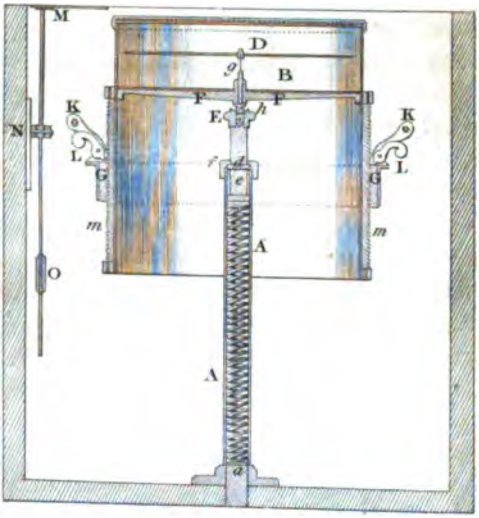


Fig. II.

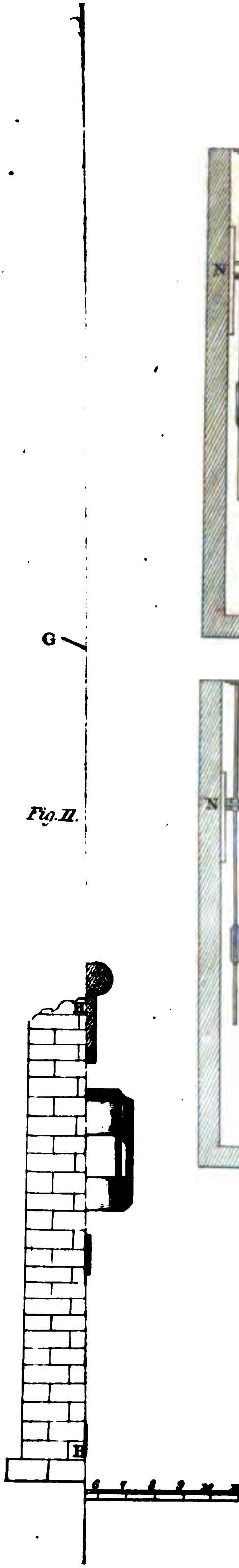
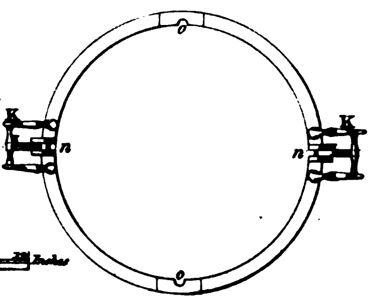


Fig. 7.



lowered at pleasure, being retained by a spring fixed to the moving centre, N, which takes its bearing against one of the guides (a front view of this will be seen in fig. 8): *o* is a pendulum bob, placed upon the stem of the lubber's point, which may be moved any where upon the stem, and it may be retained in any situation by a spring contained within the bob. This is to be adjusted so that the lubber's point, M, on the top, will be even with the upper edge of the compass, which may be done by raising or lowering the point of suspension, N, between the guides, until the desired adjustment is effected. The brass bob, *o*, should be shifted on the stem until its centre agrees with the centre of the leaden ring, by which means the lubber's point will correspond with those of the compass.

Having enumerated the various parts, and shown how they are constructed and combined, I shall now endeavour to explain the peculiar advantages that result from the improvements I have invented.

In fig. 5 the upper part of the standard, *d*, is seen resting upon the top of the spiral spring, C: therefore, when the firing of cannon, or any other circumstances, produce violent concussions, such as the sudden jerks produced by the paddles of a steam-boat, &c. the spiral spring will yield, and permit the compass to descend gently, which will effectually prevent the card from being unshipped, or thrown off its pivot, by any jar, however violent. In fine weather the spiral spring, C, should be raised by the handles, *b b*, fig. 4, until the compass receives the full effect of the spiral spring. This will prevent any injury from a sudden blow or concussion, and it will also keep the compass card always sensible.

Should the motion of the compass box or case be too great in a vertical direction, the spiral spring must be regulated to suit it by removing the handles, *b b*, up or down, and placing them in either of the notches 1, 2, 3, 4, till the requisite motion is obtained.

To regulate the pendulous motion of the compass box to suit the changes of the weather, the leaden ring, G, must be raised or lowered by the handles, K K, as circumstances may require. Whenever it blows hard the leaden ring must be raised to such a height as to reduce the motion to that degree which shall be most convenient; for instance, when the weather is bad the leaden ring, G, must be raised as high as the racks, *m m*, on each side will permit; and in fine weather, on the contrary, as low as it will allow. Thus the pendulous motion of the compass may be adjusted to suit the circumstances of the weather in any case, and the palls, L L, will drop into the teeth of the racks, and retain it there.

For I shall here observe, the intention of the leaden ring is to form an adjustable weight, by which the centre of gravity of the compass box may either be raised or lowered at pleasure. By this simple contrivance, the motion of the compass box upon its spherical bearing may be equalized in all weather.

But in order to identify and distinguish my invention more clearly, I hereby declare that it consists,

Firstly, in suspending or supporting a ship's compass upon bearings connected or combined with an elastic spring or springs, by the application of which, in the way I have described, the unpleasant effects that have hitherto been experienced from sudden blows or concussions will be completely avoided; and, consequently, the compass card will be more secure from being thrown off the pivot than by any of the methods hitherto known or made use of by the public.

Secondly, I claim also the application of a moveable ring or weight to a ship's compass, united to the other adjusting appendages explained in the drawing; which, being combined and applied in the way I have described, will enable any person to regulate the pendulous motion of a ship's compass, and thereby produce a greater degree of sensibility in that instrument than was ever before known or made use of.

And I shall here further observe, that although I prefer the method of supporting the moveable weight, G, by means of racks and palls, as shown in the drawings, yet the same may be suspended from the case of the compass by three chains, the links of which may be placed upon hooks fixed in the case, or by a variety of means known to workmen, without departing from the principle contained in my invention, namely, that of suspending or supporting ships' compasses upon elastic springs, by which means the effects of concussions will be avoided. And also by applying a moveable weight to the cases of compasses, they may be rendered more sensible than by any means hitherto known or made use of.

And, thirdly, I claim the right of making the suspending point, or centre of a lubber's point, moveable; and also of making the pendulous bob moveable; by which means an adjustment may be obtained that will, at all times, coincide with the motion of the compass.

In witness whereof, &c. &c.

Remarks on the Properties of Cordage, and its Qualities, as affected by the mode of manufacture. By Mr. Thomas Tredgold, *Civil Engineer.*

Communicated by the Author.

WITH AN ENGRAVING.

1. The properties of a good rope will be in a great measure determined by the nature of the service it is designed for; but in all kinds, *duration* is of the first importance.

2. The means of rendering ropes durable being provided, the greatest *strength* of the material should be obtained as far as consistent with its durability.

3. Also, ropes should have as much *flexibility* as can be given with due attention to lastingness.

4. Ropes should be capable of enduring the continual changes from wet to dry. It is those changes which tend most to destroy them. This is, in a great measure, effected by saturating the fibres with an adhesive substance, which repels, and is insoluble in water; if the substance were not adhesive, it would be likely to affect the strength, by rendering the fibres liable to slide upon one another.

5. The most simple test of the fibres having been properly saturated would be, to weigh a portion of rope, and then immerse it in water, at the mean temperature, for about six hours. If it gains more than a certain rate per cent. of weight (about 23 parts per cent.), it may be considered imperfect. The proper rate of increase should be fixed by trying a portion of the same kind of rope, which has been carefully manufactured.

And that this test may also indicate the goodness of the tar, or other matter employed to saturate the fibres of hemp, the specimen should be exposed, for a limited time, to a temperature of about 120 degrees of Fahrenheit; then, if the tar used contain any essential oil, so as to render it soluble in water, it will freely evaporate at this temperature; and it is a temperature to which ropes are very frequently exposed in summer.

6. Ropes may be made to resist the admission of water by a greater degree of compactness; but this impairs their flexibility, as well as their strength, and therefore the limit of a certain weight to a certain circumference, will be necessary to prevent density being obtained by compactness so as to render ropes too rigid.

7. It will be an advantage to consider, in detail, the circumstances which have a tendency to impair the strength of ropes in the manufacture, as they have not been investigated in any published work on the subject, and yet are of very great importance. Duhamel and Robison have partially considered the subject, but a partial theory is of

very little use, and, as might be expected, is more or less at variance from experience.

Ropes are not unchangeable mathematical lines, and geometry, alone, is not competent to solve the problem. Hence it is, that theoretical knowledge sometimes gets into disrepute. This point it will be easy to illustrate. It is possible to make a rope in such a manner that, when the manufacturer turns it out of hand, each yarn of the rope shall offer the greatest possible degree of resistance to being torn asunder in the direction of the length of the rope. This rope, when new, will therefore be the strongest possible. But will it retain this equality of stress upon the strands in practice? We may readily ascertain that it will not, by examining the circumstances which take place in using a rope.

8. A rope in use is bent in every direction, and such bending must necessarily stretch the external yarns; and being often repeated, these external yarns must become relaxed, and if the strength of the rope were to be tried, after the external yarns have been stretched by repeated bending, it would be found *less* strong than when new, supposing the rope to have been made the strongest possible, when new, for both trials.

It is further evident, then, when a rope is made in such a manner that all the yarns offer an equal resistance only while the rope is new, that after the external yarns have become stretched by use, the central yarns of the stands must be liable to fail, whenever the rope undergoes a considerable strain, and the loose hemp of these broken yarns be liable to absorb so much water as to rot the rope in a short time.

9. Now in every invention and discovery by which rope-making has been attempted to be improved, the sole object has been to make new ropes the strongest possible. The effect of service has never been considered. The comparative experiments have been made only on new ropes, though it be undoubtedly better that ropes should

increase in strength by the stretching they suffer in service, so as to compensate for the decay of the material. The various patent ropes, when not very carefully made, will often have the central yarns too short; even when new; and if you load such ropes with about three-fourths of the breaking weight, the central yarns will be found broken; and these ropes should be rejected, whatever may be the result of a comparison of the whole breaking weights when new.

The preceding remarks apply particularly to a species of patent cordage manufactured for the use of the navy, by whom I know not; and I appeal to the experience of the navy whether these remarks are, or are not, founded in truth.

10. We may next proceed to examine the common principle of rope-making, and to show that combination of the patent and the common principle which will produce the best ropes.

In common ropes the internal yarns of the strands are too long, and when the rope is first made they are so much too long, that the strength of the rope depends almost entirely upon the external yarns of the strands; and ropes made in this manner are much weaker than patent ropes when first made. But in common ropes every stretching, bending, or sliding of the fibres, in wear, tends to lengthen the external yarns, and, therefore, to equalize the strain upon the yarns by more strain being thrown on the internal ones. The correctness of this inference is established by the known fact, "that common ropes are stronger after being some time in regular use;" and it seems to be the only explanation of that fact which is likely to be the true one, and was first given in my Essay on the Strength of Iron, 2d edit. p. 280, in the note.

11. The conclusion is obvious and important. A patent rope is strongest when new, but every month's service tends to destroy that equality of tension on the yarns which gave it superior strength at first. A common rope

on the contrary, is weak at first, and improves in service by the tension of the yarns approaching nearer to equality. But the tension of the yarns never can be equal in a common rope, and therefore it never has the advantage of their whole resistance.

12. The error of the process which is the object of several patents, consists in making the central yarns in the strands too short. Its length may easily be determined by this proportion.

The central yarn of a strand should be as much longer than the rope as the rope will stretch before breaking, added to the extension the superficial yarns will undergo in wear, the other yarns of a strand being regulated by the central one. The central yarn should not be shorter than this proportion, and by making it a little longer, only a small portion of strength will be lost; but it is much better to make it too long than too short. Extreme accuracy is beyond our reach; it would be easy, however, by experiment, to fix a rule that would be sufficient to guide the practice of the rope-makers; and with this correction, patent ropes will be found to answer better than any other.

13. There still remains an important point in rope-making, to which I would wish to direct attention. It is the degree of twist that there should be in the yarns when the rope is finished. That degree of twist must remain in the yarns which is quite sufficient to prevent the fibres of hemp sliding upon one another; less twist will not answer, because the yarns will draw asunder without breaking the hemp; and if more twist than is necessary be given, the effective strength of the yarn will be reduced in proportion to the angle of twist. The proper angle of twist has never been determined, yet it might be very easily done, by experiment, which would set the question at rest. Mere theorists propose too little twist, and practical rope-makers too much.

We are now prepared, in some degree, for a more theoretical analysis of rope-making.

14. Though the fibres of hemp be only slightly extensible, a rope, formed of these fibres, is very extensible; and, as we have seen, its strength is greatly modified by its extensibility. This part of the theory of rope-making has been least examined.

The least complex case for investigation is the hawser laid rope, where a certain number of yarns are formed into three strands, and these, twisted together, form a rope. In the fig. 9, (Pl. XI.) AB is the rope; CCC the three strands; and DE a yarn of one of the strands, which again may be resolved into the fibres of hemp, FF.

If the twists be all at the same angle, it may be proved that the strength of the straight fibres of hemp is to the strength of the rope nearly as the radius is to the mean between the square and the cube of the cosine of the angle of twist when the fibres are all *equally extended*, and the angle of twist measured at the *greatest stretch* the rope will endure without fracture. These are limits which have been wholly neglected in the application of theoretical principles.

15. The cosine of the angle is in general about 0·87 when the rope is stretched to the utmost, and therefore, supposing the extension to be equal, the strength is about 0·708 times the strength of the hemp, or very little exceeding two-thirds of its strength. But in most cases the loss will be greater than one-third, because the stretching of the different parts are unequal. For a strand is composed of yarns, twisted round an axis, or central yarn, AB, fig. 10. Now the length of the external yarns will be CD in the rope without strain upon it, but when it becomes strained, the parts become compressed, and the diameter of the circle of external yarns decreases, and allows the outside yarns to extend, and the ropes to lengthen, as shown by the strand EF, so as to throw the strain upon the inner

ones, unless they be just so much puckered up in making the rope as to take the same extension of length as the outside ones.

To arrive at this exact proportion, which renders the inner yarns and outer ones equally strained, ought to be the object of the most improved method of rope-making. The common mode of rope-making runs to the opposite extreme, the interior yarns being too much puckered up, so as to throw the whole stress upon the exterior ones; and the ropes made in this manner stretch permanently in a very considerable degree, and they also absorb a greater quantity of moisture than the improved ropes.

But it is better to make the external yarns of the strand too short than the internal ones, because the internal yarns being too short, the strain is greatest on the middle yarns, which must necessarily break, and after them the next yarns to the centre; and consequently the central part of the rope being broken, it will absorb water, which will tend to rot the other yarns. This is the defect to which the new principles tend when not properly managed. In the old mode the greatest strain was thrown on the outer circles of yarns in the strands, and if they failed, it was immediately seen.

16. It is easy to ascertain when the strands of a rope are made in such a manner that the yarns will be equally strained; for in order that they may be so, the central yarns, when taken out of the strand, should be about $\frac{1}{10}$ longer than the strand itself, as measured with the twist in it. In fact, a scale might be easily formed for measuring the whole of the yarns so as to detect any material deviation in the manufacture.

17. In the cable laid ropes a greater loss of the strength of the hemp necessarily takes place.

In fig. 11, AB is the cable; CCC the three ropes which form it; DDD the three strands of one of the ropes; and EF a yarn, resolved into the fibres of hemp, GG. Now owing to the cable being one more time twisted than a hawser laid rope, it may be demonstrated that the direct strength of the hemp is nearly to the strength of the cable, as the radius is to the mean between the third and fourth power of the cosine of the angle of twist when the cable is manufactured, so that the fibres are equally extended by the straining force. Or that its strength is to the strength of the three ropes which form it, simply as the cosine of the angle of twist, and at the common angle, this will be nearly as 87 to 100. That is, there are 13 parts in 100 of the strength lost by making cable laid ropes. But the loss of strength is compensated by the greater degree of compactness which is gained by this combination; for the compactness is not accompanied by a corresponding increase of stiffness. In cable laid ropes the same attention is necessary to equalise the strain on the yarns in the strands as in hawser laid ropes.

18. Since, from correct theory, it is evident that the extension should be equal in every part of a rope, it is most simple to form it so that the twist of every yarn should be as nearly alike as possible, and also the twist of every strand. Hence, it is probable, that machine-made ropes will be found superior to others, all other circumstances being the same; and if the hemp be spun into yarns by machinery, it will most likely be found an advantage.

19. Should these remarks have any tendency to improve an art of so much importance to this country,—should they tend in any degree to decrease the expense, and increase the strength and safety of cordage, I shall feel myself amply compensated for the trouble of examining and comparing specimens, and analyzing the power of the material in different combinations.

20. Those who are inclined to prosecute the inquiry, will find much information in the careful comparison and dissection of specimens in different states of wear, and of different species of manufacture. This is by far the most certain method of arriving at the truth, and of avoiding

prejudice. The writers that may be consulted with most advantage are Dr. Young, Chapman, Duhamel, and Dr. Robison. The pamphlets by Messrs. Huddarts, and others interested in particular systems, may also be consulted with some benefit, after an unbiassed study of the general principles of rope-making.

Plan for a Tunnel beneath the Thames.

Signed T.

Abstracted from the Papers and Documents of the "THAMES ARCHWAY COMPANY."

THERE are four sections given in the drawings of this plan for tunnels which differ in size and form. The first is intended for a carriage-way, with a narrow footway at each side. The outline of its section is composed of four segments of circles, those forming the sides being of a radius equal to the diameter of the tunnel (which is 12 feet inside), the bottom one having a radius of 10 feet, and the top one (which forms the roof) having one of 7 feet.

This is represented as being filled up a foot and half from the bottom, to form the road-way, which thus occupies the whole of the lower segment. A small passage for the water, only 6 inches high, is left beneath this road; and the foot-ways at each side of it are elevated a foot and half above the road, to gain more space, which, though but two feet broad, leave the carriage-way only 7½ feet across.

The second section is composed also of four segments of circles, but arranged so as to produce a different form; as it is 16 feet from bottom to top inside, and only 10¼ feet across in its greatest breadth. The use of this greater height is to leave room for foot-ways in a second stage over the carriage-way, which foot-ways are supported by beams that pass across, about 8¾ feet from the bottom. The foot-ways do not occupy the whole of the breadth at that elevation, there being a space of 18 inches left between them and the sides, for the purpose of letting the light of the lamps pass downwards, which are placed a foot and half above the beams, and by this position can light both the upper and lower passages at the same time. The road is raised the same height from the bottom as in the foregoing section, and is furnished in like manner with a small drain beneath it for the water.

The third and fourth sections are designed for foot passengers only. The former of these is circular, and 9 feet in diameter inside, and the other is formed of four segments of circles, in nearly the same proportions as the section first described, but having only the diameter of 9 feet inside in its greatest breadth. The road or way in both of these is raised a foot and half from the bottom, and has a small drain beneath it like the others. They are also lighted by lamps placed over the top.

All these four sections were designed to regulate the shape only; but the mode of construction was to be the same for all the methods included in this communication.

The body of the tunnel for each of the sections was to be formed of a number of "cast iron cylindrical plates," or more properly segments of cylinders; the circumference of the first comprising 27 of these plates, that of the second 30, and that of the third and of the fourth 18 each. Each of these plates was to be about 2 feet in breadth, and to have flanches raised externally at its four sides, about 6 inches in breadth, by which flanches they were to be fastened together externally by nuts and screws.

Outside this cast-iron body a coat of cement, or of hard rammed clay, 5 or 6 inches thick, was to be laid, and the whole was to be inclosed in a casing of wooden planks.

For excavating through quicksand an apparatus is proposed in this paper, consisting of a grating, with apertures of about an inch and half across, to be placed upright across the front of the drift; and by impelling crow bars through these apertures, it was designed to make the sand pass down in such moderate portions as would be most convenient for carrying on the work without incurring the danger of too large a quantity tumbling in at one time.

Of Lime which hardens in Water. By M. Hassenfratz.

(Continued from p. 253.)

"Thus it is proved, that any mixture of which silex does not form a part, cannot acquire hydraulic properties; but it remains to be known whether the presence of magnesia, of alumen, and of the oxides of iron or of manganese are injurious, or if these substances are, on the contrary, proper for improving hydraulic lime. But it appears to result, from the small number of experiments which I have made on this subject, and which I am about to make known, that the limes which contain, at the same time, silex and alumen, and, still better, those which contain silex and magnesia, acquire hardness more considerably than the silicates of pure lime, and that, on the contrary, the oxides of iron and of manganese in no respect contribute to the solidification of limes.

"Ten grams of magnesian carbonate of Paris, No. 7, and two of gelatinous silex, produced a lime which slacked with a feeble heat and a slight inflation, and which, after immersion for a short time, became more hard than the best artificial hydraulic lime. This lime was composed of

Lime	0·560
Magnesia	0·166
Silex	0·274

Ten grams of the magnesian lime-stone of Villefranche, No. 8, and two grams of gelatenous silex, gave a lime which had nearly the same properties as the preceding, but it did not acquire so great a hardness. It is composed of—

Lime	0·46
Magnesia	0·20
Oxide of iron	0·05
Oxide of manganese	0·03
Silex	0·26

With ten grams of the lime-stone of Villefranche, 20 grams of chalk, and 3 grains of gelatanous silex, I composed a lime consisting of—

Lime	0·56
Magnesia	0·21
Oxide of iron	0·02
Oxide of manganese	0·01
Silex	0·20

which was eminently hydraulic, and which acquired, after a little time, a very great hardness.

"If we consider that most of the hydraulic limes, and even the *Roman cement*, are produced by argillaceous lime-stones, it will appear evident that alumen does not injure limes of this species; and in comparing the artificial lime of Paris with that of Senonches, it will be seen that the alumen, which is not found in this latter, and which, on the contrary, exists in a large proportion in the first, contributes to give them their hardness. There is certainly a relative proportion of silex and alumen which is preferable to every other; but this proportion will not be ascertained but by many tedious researches. An experiment made on a large scale, with four parts of chalk and one part of kaolin of Limoges, gives reason to believe that it would be advantageous that the quantity of the alumen should equal that of the silex. This lime, which was composed of—

Lime	0·745
Alumen	0·125
Silex	0·130

acquired, in a very short time after its immersion, a consistence harder than that of the artificial lime, prepared with four parts of chalk and one part of the clay of Passy.

"A lime, prepared on a large scale with four parts of chalk and one part of yellow ochre (in bulk), and which contained—

Lime	0·745
Alumen	0·055
Oxide of iron	0·070
Silex	0·130

acquired only a very weak consistence, even after being immersed a long time. It is impossible not to attribute the bad quality of this lime to the oxide of iron, since, with a quantity of clay equal to the proportion of ochre employed, a lime, eminently hydraulic, was constantly obtained.

"In a platina crucible 10 grams of chalk, 2·5 of carbonate of manganese, and 2·5 of gelatinous silex, were calcined. The roasted matter was of a violet colour, and slacked with heat; a soft paste was made of it, which was placed under water. At the end of two months it had not assumed any consistence, whilst the chalk and the silex by themselves had produced a lime which quickly solidified.

"Although the experiments which I have reported were made with a great deal of care, I must observe that it would be wrong to give an entire confidence to the results which they afford, because the assay of hydraulic limes, on a small scale, is subject to many difficulties. It may be affirmed, that a lime which was found to be hydraulic in a small experiment would also be so when it was prepared in a large quantity; but the inverse does not equally take place. The duration of the roasting considerably influences the result; for each mixture a certain degree of heat is necessary, which must not be exceeded; and a mixture which would have produced a lime eminently hydraulic, if it had been exposed to a proper temperature, and during a sufficient time, will only yield a meagre lime if it has not been sufficiently heated, or a dead lime if it has been heated overmuch."

In comparing the experiments which M. Berthier published in 1822, with those which we made in 1806 and 1807, and which we communicated to MM. the pupils of mines, nearly at the same time, some of the results will be perceived to be the same, and some different. We stated, p. 176, that the lime which was only composed of lime and silex was attackable by water, and could not become hard in this fluid. M. Berthier asserts that silex, combined singly with lime, renders it capable of soldifying in water; however, M. Berthier assured himself, as we did, that the mixtures of chalk and common white sand only produced *meagre non-hydraulic limes*; he obtained, it is true, with 10 grams of chalk, and 1·5 grams of *gelatinous silex*, a lime which formed a consistent paste in water. But is the *gelatinous silex* a pure silex? Does it not retain, by the action of its mass, some alkali which the acids and the washing could not remove? Finally, has it not, in this particular state, properties which pure silex does not possess? Who can be certain that a very small quantity of alkali does not change the properties of silex? M. Berthier asserts, moreover, that alumen singly, or magnesia, has no efficacy in rendering limes hydraulic. As to alumen we agree; but we differ with respect to magnesia. We ascertained, by experiment, that this earth, in a pure state, combined with lime, renders it capable of hardening in water. M. Berthier does not cite any direct experiment; he only reports that the lime-stone of Paris, composed of lime, magnesia, and clay, yields a meagre non-hydraulic lime; and that the lime-stone of Villefranche, composed of lime, magnesia, and iron oxide, also produces a very meagre lime, which is not hydraulic; but the lime-stone of Paris contains, according to M. Berthier, 28 parts of magnesia in 100 of lime; and we have experienced that when the proportion of magnesia was 20 in 100 of lime, this combination began already to solidify with difficulty in water. As to the lime-stone of Villefranche, it contains also, according to M. Berthier, 43·6 of magnesia in 100 of lime, which is also too great a proportion. We perfectly agree that silex is one of the principles which contribute to give to lime the faculty of hardening in water, but we differ in thinking that it is necessary that it should be combined with alumen, or with magnesia. Finally, we also agree respecting the effects of the oxides of iron, or of manganese, singly; but we think that it has not been perfectly demonstrated that they are altogether passive when they are combined in certain proportions, either with magnesia alone, or with the combinations of silex and alumen, or of silex and magnesia. Let us wait to decide until we have a sufficient number of experiments.

What we can at present point out as worthy of remark is, the analogy which subsists between the limes naturally carbonated, and the combinations of lime with various substances. We know not whether pure carbonates of lime and of magnesia exist, but a great number of carbonated magnesian limes are found; magnesia combined with lime varies from 0·04, as the lime of Tocaleton; to 0·16, that of Gazzo, all which limes harden under water; and, finally, to 0·41, the antique marble. There are many mixtures of silex and lime among the silicated carbonates of lime. The filtering stone, for example, contains of it 0·20, and the whitish grey marle 0·40. As to the combinations of lime with silex, they are very rare, or in small proportion. However, tabular spath contains 0·50 of silex; but in this mineral the lime is not in the state of a carbonate, and every thing leads to the belief that this stone cannot produce lime good for building. A great number of combinations of iron with lime are found in the ferriferous carbonated limes; the proportion of this metallic oxide varies from 0·07 in pearl spath to 0·98 in the ores of spathic iron. The silicates of magnesia, combined with lime, are also very common in the carbonated magnesian limes, but its proportions are very variable, whether in the silex and the magnesia, or in the silicate and the lime. The argillaceous carbonated limes are also very common, but the combined clays are extremely abundant, and present considerable varieties in their proportions, since they extend from 0·01 to 0·50. The proportions of silex and alumen are likewise very different. We have now a variety of carbonated lime to which Hauy has given the name of *alumenous*, which leads to the belief that combinations of carbonated lime and alumen also exist in nature. This denomination, given from the analyses of Kirwan, who found chalks composed of 0·96 of lime, and 0·04 of alumen, and a marle of the bishoprick of Lude, containing 0·62 of lime, and 0·38 of alumen; and also from the analysis of Saussure, the son, who found in a stone 0·10 of alumen, and 0·90 of lime, has afterwards been altered by Hauy, because it was proved that Kirwan and Saussure had mistaken magnesia for alumen.

It follows from these observations, that the results of our experiments, and of those of Berthier, approach near to the combinations existing in the natural carbonates of lime, and that it may be doubted whether the alumen was combined with the lime in the calcination, which the mixture of these two substances was made to undergo.

Another species of lime is noticed, to which the name of *plaster cement*, or *Roman cement*, has been given. This lime, discovered long since in England, was brought into commerce by Messrs. Parker and Co. It exists also in France, and is found near to Boulogne-sur-mer. It differs essentially from common lime; 1st, because it does not slack like it, which is caused by the strong calcination which it undergoes; 2dly, from its only showing a feeble heat when it is moistened; 3dly, from its being absolutely necessary to reduce it to powder; and 4thly, because as soon as it is moistened with water, and has been mixed and worked up, it hardens rapidly, in the manner of plaster (gypsum). This lime may be considered as a true *beton* mortar, or natural cement. The name which would be most appropriate to it is *natural cement*, hardening like plaster.

The English stone, which furnishes the *Roman cement*, is compact, of a very fine grain, hard, tenacious, susceptible of a beautiful polish, and of a brownish grey colour. Its specific gravity is 2·59. It often contains small round cavities, holding a yellow crystalline transparent substance, which some makers of cement take to be sulphate of lime. M. Berthier, however, satisfied himself, by an analysis which he made, that this substance is a carbonate of lime, and he neither found sulphate of lime in the stone which he analyzed, nor in the cement. It was thought that the cement stone existed only in a single part of England; but after some years it was found in several places, and it is said to be very abundant. According to the analysis of M. Berthier this stone contains,—

Carbonate of lime		0·637
Carbonate of magnesia		0·005
Carbonate of iron		0·060
Carbonate of manganese		0·019
Clay	Silex	0·180
	Alumen	0·066
Water		0·013
		1·000

Guyton and M. Drapier have also analyzed the *plaster cement* of Boulogne; they have both found in it carbonate of lime, silex, alumen, oxide of iron, and water; but the proportions which they have given present some differences, which arises probably from variations in the stones which were collected. These are the results of the analyses of the two chemists:—

	M. Drapier.	Guyton.
Carbonic acid and water	36·00	33·00
Lime	34·50	40·00
Silex	15·00	9·09
Alumen	4·75	4·05
Oxide of iron	7·00	11·03
Loss	2·75	1·01

In these three analyses the quantity of argil formed by the union of the silex, the alumen, and the oxide of iron, is considerable; it is 80 to 100 parts of pure lime; in the English stone, 77, according to M. Drapier, and 60 according to Guyton. In the stone of Boulogne, for 100 of the composition, 44·6; in the English stone, 43·6, in the analysis of M. Drapier, and 37 in the analysis of Guyton. These quantities are, as may be seen, very considerable. The proportion of the alumen in the clays which these stones contain, is greater than what is usually found in common clays; it is 0·27 in the English stone, and in the Boulogne stone 0·24, from the analysis of M. Drapier, and 0·30 from that of Guyton; but this latter stone contains much oxide of iron, for, according to M. Drapier, there is 0·32 of it in the lime, and, according to Guyton, 0·206. This great quantity of iron oxide, in a lime which hardens so quickly, seems to prove that the oxide of iron does not injure the hardening property of this lime.

To be continued.

ACCOUNT OF NEW PATENTS.

Patent granted to JAMES KAY, *of Preston, Lancashire, for machinery for preparing and spinning flax, hemp, and other fibrous substances, by power.* Dated July 26, 1825.

THE preparation of the flax used by the patentee is to macerate it in water as it is drawn out in slivers, previous to being spun. For this purpose he uses the common machine for drawing out the flax into narrow slivers; but instead of passing it to flys and bobbins for spinning, he places long narrow cans to receive it, which convey it into perforated vessels, into which they fit, and which are fixed in troughs containing water. When the slivers of flax are coiled up in the cans by the action of the machine, they are pressed down by a sort of pistons or rammers into the water, till all air is separated from between the fibres; and when the lower vessels are full, they are separated from the cans, and after being left for six or more hours, for the flax to macerate, are taken to the spinning machines, where their contents are transferred into other troughs, by turning them upside down, and the ends of the slivers being then placed between the rollers, are spun in the usual manner.

The spinning machines differ only from those in use in having the retaining rollers placed much nearer to the drawing rollers, the distance between them being, in the machines of the patentee, merely two and a half inches; the retaining rollers in these are preferred by him to be fluted, and to be made to revolve one turn only for every eight of the drawing rollers.

This close position of the sets of rollers, the patentee states, is permitted by the maceration of the flax, which allows the rollers to draw out the fibres in much shorter lengths than would be possible without this operation, by which means much finer thread can be made from the same materials, which arises, we suppose, from the fineness of the fibres thus drawn out bearing a due proportion to their shortness.

The machines are represented in the drawings of this specification as being of the vertical sort, with the sets of rollers placed one above the other, instead of being in a horizontal plane, as others are made, for the same purpose. This position gives them the advantage of requiring no revolving belts, or other apparatus, to convey the slivers from one set of rollers to the other, and will also enable them to take up less space in the factory.

The management of flax is only described by the patentee; but it is easy to conceive how other materials of a similar nature are to be prepared and spun from these directions; and also how the machines are to be set in motion by the power of any of the usual first movers, though no precise instructions are given for this purpose.

Patent granted to James Hanmer Baker, *of Antigua, but now of St. Martin's Lane, Middlesex, Gentleman, for improvements in the arts of dyeing and calico printing, by the use and application of a certain vegetable material or materials.* Dated March 29, 1825.

The new materials proposed by the patentee for the purposes stated in the title of this patent, are the husk, leaf stalks, stem, and roots of the cocoa nut tree; but, preferably, the husk of the nut and the leaf stalks: which may be prepared for exportation either by being dried, or by being infused in hot water, and having the infusion boiled down to an extract; the stem and roots, when used in either way, being previously split into small pieces. The patentee does not, however, recommend the use of the extract, as the colour is apt to be affected by the mode of its preparation.

The nankeen colour is that for which this material is chiefly valuable; and when it is to be used for dyeing, that which is dried is to be first reduced to a powder by rollers, or by rasping, grinding, or any other common method. It is then to be put into a vat, and a frame laid upon it to keep it down, and an infusion to be made from it either by hot or cold water solely, or with the addition of potash, lime, or ammonia, or other alkaline substance. Fresh liquor is to be three times poured on the same materials, or three infusions to be taken from them; and if the last is weak, which may be known by the colour, the used materials are to be removed, and replaced with a fresh parcel. Into this infusion the goods required to be dyed are to be first dipped, and afterwards in liquor containing any common mordant, which is perfectly free from iron; but of these the patentee prefers alum, rendered neutral by chalk or lime.

When the infusion is used for calico printing, the whites may be stopped out in any pattern by *reserves* in the common way; and the goods being then dipped in it, and afterwards passed through solutions of alum, of muriate or nitromuriate of tin, of nitrate of lead, or of oximuriate of lime, will produce the proper effect; but after the application of the latter substance, the goods must be speedily washed to prevent the total destruction of the colour. The reserves being then removed by the usual methods, the goods are to be finished by the means generally applied for that purpose.

As the material holds tannin and gallic acid, it may be used on some occasions as a substitute for galls, and for this reason may be applied for dyeing black, in conjunction with salts of iron, of which the patentee prefers the pyrolignate of that metal.

Olives, slate colours, and several other shades, may also be produced by using this material, along with others, in the same manner as that employed with other substances of similar qualities.

To dye a nankeen colour so as to resemble, with any accuracy, the natural tint of the Bhaugalpore cotton, and so as to hold it durably in washing, is a point much desired by dyers; and if the patentee can effect this difficult matter by his new material, he will confer a great improvement on their art.

For the other colours which he mentions there is no want of materials, those in use being very abundant.

If, however, the cocoa tree can afford an effectual substitute for galls, as asserted by the patentee, the discovery must be very valuable; but we must be allowed to doubt the fact, until it has received the test of ample experiment by the trade.

Patent granted to JOHN BIDDLE, *of the parish of Donnington, county of Salop, Glass Manufacturer, for a machine, or combination of machinery, for making, repairing, and cleansing roads and paths, which machinery is applicable to other purposes.* Dated July 8, 1825.

THIS machine consists principally of three iron rollers, for compressing loose gravel on a road, followed by a fourth, of a peculiar construction, for taking up mud, which may be separated from the rest when not wanted for that purpose. The three first rollers are arranged in a frame so as to roll over three different paths; but instead of being placed side by side, the first precedes the second, and the second the third, by about the length of their spokes. In front of these rollers is placed an iron scraper, of a sufficient depth, at an angle of 45° with the line of the road, attached to the frame by four vertical bars descending from it, furnished with adjusting screws, by which its precise distance from the surface may be regulated. Its head is a little curved forwards, to enable it the better to enter the gravel or other matter lying on the road. Above the rollers an open case is supported by uprights from the frame, on which may be carried gravel for the road, the weight of which will make the rollers act with more force; and a pair of shafts, attached to the frame a little before the scraper, completes this part of the apparatus.

When these rollers and scraper are drawn over a road covered roughly with fresh gravel, the scraper being regulated by its screws to the distance required from the surface, will cause all the superfluous gravel to pass along its inclined plane to its further end, where it will be deposited in a ridge, ready for being again spread out; and the rollers coming on immediately after, will compress the gravel so levelled, and bring it sooner to the state of hardness most favourable to the passage of wheels.

When the machine is used for scraping thick mud off the road, the scraper must be lowered down closer to the surface than for its former application; but when the mud is very thin, or in a semifluid state, the fourth roller, before mentioned, is to be hooked on at the hinder part of the frame, to remove it more effectually. This fourth roller is as broad as the three other rollers collectively, and has its surface perforated all round with small apertures or slits, three inches in length, and a fourth of an inch in breadth, placed as close together as is consistent with its strength. Inside this roller, on its axle, is suspended an open box for receiving the mud, which occupies as great a part of the lower half of the roller as the space necessary for its free motion will allow. From the top of this box, at each side, curved arms ascend near to its higher part; on which is supported, by pivots, a long brush, that reaches quite across from side to side, whose face is in contact with the inside of the roller, and which has a lever descending from it, to which a weight is attached, by the action of which it is always pressed against the internal surface of the roller as this revolves. Two scrapers are placed in front of this roller, one at each side, inclined to the line of the road in the same angle as that before described, but in a direction reversed to each other, by which the mud is drawn from the sides towards the centre of the roller; there is also fixed in the side of the box, near its bottom, a small door, by which its contents may be discharged when required. The whole being prepared as explained, when this perforated roller is drawn forward in the thin mud, this will enter into it through the apertures left for it, and the rotary motion will then raise it up till it rises above the level of the axis; after which, it will begin to fall into the box, and what remains attached when it ascends as high as the brush, will be swept back again by this implement, and be made to follow the first into the receptacle.

When fresh gravel is first laid on a road, the carriages which pass it are greatly impeded in their motion by the wheels sinking into it, and all the labour lost in overcoming the resistance thus caused, goes to the destruction of the gravel, by grinding it into powder, and by rounding off its angles renders its consolidation more tedious and difficult; for these reasons, the advantages which rolling down gravel as soon as it is laid would bring both to carriage owners and to those who pay for keeping the roads in repair, must be obvious; as it must also be that the expence of this operation would be very amply repaid, perhaps to several times its amount, by the greater durability which it would cause to the road materials, to say nothing of the wear of carriages and horse labour which it would save.

From this view of the subject we think contrivances for rolling roads should be encouraged; and that which forms the object of the present patent appearing to be very well calculated for the purpose in several respects, seems to us to be at least entitled to a fair trial. The effect of the perforated roller for taking up thin mud, is somewhat more doubtful than that of the rest of the apparatus; and we are inclined to imagine, that the greatest part of the mud which entered its apertures would run out again through them and at the sides, instead of being raised up so as to fall into the receptacle; but being always desirous to forward the objects of ingenious individuals, we will suggest to the patentee that this defect might be in a great measure, if not entirely, removed, by fixing ledges across to the inside of the roller, a few inches asunder, which, by a proper arrangement of their angles of inclination to the radius, might be made to retain the mud until, by the revolving of the roller, they were brought above the level of the receptacle.

Patent granted to William Furnival, *of Anderton, Chester, Salt Manufacturer, for improvements in the manufacture of salt.* Dated December 5, 1824.

The improvements of the patentee relate to the construction of the boilers for evaporating the saline liquor, and of the apparatus connected with them.

The greatest part of the principal boiler is made flat and shallow, like those in common use, with two or more fire places beneath it, but differs from them in having part of one end made three or more times deeper than the rest, according to the drawing, which part the patentee calls the "side" of the boiler. This part is supported by brick work only, and separated from the fire place, which is at one side of it, by a wall, by which arrangement it is kept much cooler than the rest, and forms a receptacle for the salt, where, receiving no further action from the fire, it can have no tendency to adhere to the bottom.

Above this first boiler a second is placed, a few feet higher, and the space between both is inclosed by steam-tight partitions. In this space a sloping plane, like a roof, passes from the outer end of the bottom of the upper boiler to the inner end of the top of the lower boiler, in which roof an opening is made, covered at top like a dormant window; the use of which contrivance is to prevent the water, formed by the condensation of the steam against the bottom of the upper boiler, from falling into the lower boiler, instead of which it runs down the roof into an iron pipe, that conveys it to a culvert beneath the floor, through which culvert the pipe passes that conveys the brine to the upper boiler, and thereby causes it to receive some heat from the hot liquor there, through which it is thus transmitted. The pipe through which the hot water passes to the culvert is inclosed in a second pipe, from which other pipes rise, a little above the roof, into the space between the two boilers, while its lower end opens into the ash pit; by which means, when the doors of the ash pit are closed, the draft of the fire will cause air to pass downwards from that space, through the outward pipe. Through one end of the upper boiler a large tube rises, by which the steam may be admitted to the bottom of a third boiler when required, but which is to be kept close covered when not applied to this purpose. Lastly, a rake is inclosed in the lower boiler, the handle of which passes out at one end of the partition through a stuffing box, directly over the deep and cool division of the boiler, into which, when thought proper, it draws the salt from the hot part of the boiler.

We have described only a single apparatus fitted up as above, to facilitate the explanation; but it is evident that two or more may be connected so as to somewhat economise walls, partitions, and some other parts; and the patentee, in his drawings, has represented two boilers thus connected, end to end. We think, however, that if more than three were connected in this manner, so as to have any parts in common, that the fire places of some of them would be much in the way of the others, when receiving a fresh supply of fuel.

The patentee claims five articles of the above apparatus as his peculiar right:—1st, The cooler '*side*,' or deeper part of the boiler separated from the action of the fire.

2dly, The sloped roof above the first pan, and the mode of heating the second pan. 3dly, The rake, with its handle passed through the stuffing box. 4thly, The conveyance for the hot liquor into the culvert, through which the brine pipe passes. And 5thly, the air tube, through which the air from the space between the boilers is drawn into the ash pit, when required.

It is evident from the arrangements described, though not particularly mentioned by the patentee, that it is intended to heat the brine in the upper pan, and cause some evaporation from it, before it is admitted into the lower pan.

The chief feature of the arrangements of the patentee is, the cooler, and deeper division of the pan at one end for the receptacle of the salt. In the specification of Mr. Smith's patent, dated June, 1823, which is inserted in our 44th vol. p. 74, will be found a contrivance for the same purpose; and another, of a singular and somewhat whimsical construction, in the account of Mr. Parkes' patent, in the 1st vol. of our present series, p. 281. The plan for heating successive boilers by the steam from the first, has been long since practised at Cheltenham, and we believe also in some salt works on the Continent, in what they call the *graduation* of the brine, where also several other ingenious methods are practised for the same purpose.

It should be observed of those methods, of having cooler receptacles for the salt connected with the boilers, that if there are any earthy salts, or sulphate of soda, in the brine, they will be sure to be deposited in these cooler places, so that the salt from such works must be more than usually impure, unless those salts are separated from the muriate of soda by previous processes.

Patent granted to THOMAS COOK, *of Upper Sussex Place, Kent Road, Surrey, Lieutenant in the Navy, for improvements in the construction of carriages, and harness to be used therewith, whereby greater safety to persons riding in such carriages, and other advantages, will be obtained.* Dated July 16, 1825.

THE specification of this patent relates solely to a contrivance for causing the rotation of one of the wheels of a carriage to draw in check reins, connected with the bits of the horses' bridles, whenever the driver may think proper, who has also the power of instantly again releasing the horses from their operation, by which means the strength of the horses can be made to act in opposition to them when inclined to run away with the carriage.

Five varieties of the apparatus for drawing in these check reins in this manner are described, in each of which it is placed in a small case adjoining to the wheel on which it is to act. In the first of these a bevelled toothed wheel, attached to the inside face of the nave of the front wheel, turns a similar wheel in the box, which is made fast to the axletree. This wheel has a crank connected with its axis, which, as it revolves, moves a catch back and forwards that acts on a ratchet wheel at the other end of the little box, so as to move it round the space of one tooth for every revolution of the first wheel. A spring catch is placed at the opposite side of the ratchet wheel, to prevent its going back when the impelling catch moves forward to act on another tooth. A lever also turns on a pivot at the same end of the box, one extremity of which is near the primary impelling catch, and the other projects beyond the box, where a weight is fastened to it, which, when permitted to act, throws up the impelling catch from the teeth of the ratchet wheel, by causing the opposite end of the lever to press up against it as itself descends.

On the axle of the ratchet wheel is a cylinder, to which a strong strap is fastened, that passes round a roller in the centre of the bed of the axletree, and from thence proceeds forwards along the pole, sending off branches to the bits of the wheel horses, and terminates in similar branches attached to those of the front horses.

From the weight which throws the impelling catch out of work, a cord or strap is conveyed up to the coach-box by pullies and guides, properly disposed, where, by a ring on its end, it is suspended on a hook, when the apparatus is required to act in drawing in the check reins; and on the driver again taking the ring off the hook, the weight descends, throws up the impelling catch, and the horses remain curbed up to the degree to which the strap has been drawn in by the cylinder of the ratchet wheel.

From the spring catch, which keeps the ratchet wheel in this latter state, a wire or cord rises up likewise to the coach-box, similarly to that described, where it ends in a knob or button over a spiral spring; on pulling up which knob the catch is drawn up from the ratchet wheel, which, being thus released, at once lets go the strap, and the check reins connected with it, and frees the horses' heads from its powerful retraction; the springs again press the catch down on the ratchet wheel, when the driver lets go the knob.

The second variety of the apparatus is altogether similar to the first, except that the box, which holds it, is attached to the hind axletree instead of to that in front, and it of course receives its motion from the hind wheel. The strap that draws in the check reins, and the wires or cords which act on the two catches, must in this case proceed along the perch; and being much longer, will require more guides and pulleys, arranged conformably to these circumstances. In either of these positions the apparatus described may receive another alteration, by the crank wheel being placed over or under that on the nave, both being made spur wheels, having its axle prolonged to the middle of the axletree, where the crank is to be placed, and being made, by the impelling catch, to act on the ratchet wheel, which is inclosed in a box fixed in a line with it. There is also a method described for fixing this apparatus between the futchels, which, except in position, has no material difference from those mentioned.

The third variety is considerably different from the first. Instead of operating by an impelling catch, moved by a crank, the wheel of the carriage acts at once, when required, on the cylinder, which draws in the strap of the check reins, by the driver pressing towards the nave a sliding collar on the axletree, the face of which has projections, which are acted on by studs on the inside face of the nave when in this position, that cause the collar to turn round; and the cylinder for drawing in the strap being attached to it concentrically, then acts as the other before described. The sliding collar is moved back and forwards by a lever, which has a handle within reach of the driver, who by it can make the wheel act to pull in the horses, or release them again, as he desires. This method is intended for gigs, or other two-wheeled carriages, but may be used for those with four wheels, by having wires or cords properly disposed between the lever and the seat of the driver.

The fourth variety, like the third, is put in or out of action by a lever that acts on a sliding collar; but in this case the collar runs on a stud or pivot, placed at right angles to the axletree, and above it; and a bevelled toothed wheel is attached to the collar, which catches in the teeth of a similar wheel on the inside face of the nave, when the collar is lowered down on it by the lever, and is raised up from it again along with the collar, when the lever is moved the other way. A lever, with its handle at right angles to the arm that acts on the collar, is most convenient for this variety when used for two-wheeled carriages.

The fifth variety only differs from the last by having the sliding collar beneath the bevelled toothed wheel, instead of being in a higher position.

The patentee finally declares, that several other methods may be devised for causing the motion of the wheels of a carriage to draw in check reins, all of which he claims as his right.

The plans of this patentee appear to us liable to cause serious mischief to the horses, who, when in full course, could not stop themselves quick enough to be released from the effects of its violent operation on their mouths. A great variety of powerful bits and curbs having been long since invented, there does not seem to be any necessity for aiding the driver by a force greater than what they would enable him to exert in a manner as effectual as by the complicated and more expensive apparatus of the patentee.

Patent granted to JOHN REEDHEAD, *of Heworth, Durham, Gentleman, for improvements in machinery for propelling vessels of all descriptions, both in marine and inland navigation.* Dated July 26, 1825.

THE machinery for which this patent was granted, operates in moving a paddle in the water a considerable distance, in a right line, contrary to the course of the vessel, and returning it back again to its first position, raising it up backwards at the same time, so as to give no impulse to the water in that direction. It consists of a horizontal frame, that is moved back and forwards in a groove by a vertical toothed wheel, which operates on a rack attached to it at one side. Within this frame is suspended another frame by an axle, that passes across it at about a third of its length from its hinder end, thus forming it into a lever with two arms, of these proportions. To the head of the long division of this latter the upper part of the paddle is joined, a little below its upper extremity, in such a manner as to admit of its being bent backwards close to the frame, and only of being moved forwards to a position at right angles to it, being prevented by a step in the frame from moving further in that direction. At the top of the paddle is a friction wheel, whose use is to keep the paddle from rising when impelling the vessel, there being a horizontal plane placed over where it moves, against which this friction wheel rolls as the paddle is worked back and forwards. On the shorter and hinder division of the frame to which the paddle is jointed, there is fastened an inclined plane that slopes upwards and backwards, and a roller is placed across it in the case that incloses the machinery within the vessel, which, when the frame is moved forward by pressing down this inclined plane, causes the other end of the frame to rise, and elevate the paddle along with it, as this latter is moved forward to give a fresh impulse to the water. In the fore part of the horizontal plane, against which the friction wheel in the head of the paddle works, there is an opening of a short extent, that admits the friction wheel and part of the upper end of the paddle to rise through it when it is near the end of its course in that direction, by which means the bottom of the paddle is enabled to fall down at right angles to the frame, when this latter is drawn back by the action of the vertical wheel on the rack that is attached to it. The vertical wheel does not turn entirely round, but is moved through part of a revolution and back again by an arm which projects from it, and which is moved up and down by the beam of a steam-engine, to which it is connected by an iron rod.

This machinery appears to us to be incapable of performing the motions for which it is intended, without some material additions. But we conceive it to be unnecessary to enter into explanations of the particulars of these deficiencies, when we are convinced that its principle is bad, as the paddle will by it be moved so far back before it will fall down at right angles to the frame, so as to give an impulse to the water, that much of the power will be thereby wasted, or, what comes to the same conclusion, much of the time will be spent to no purpose during which the power is in full action. For these reasons we do not hesitate to say we prefer the common revolving paddle wheel for impelling vessels, notwithstanding its well-known defects, to the machinery of the patentee, either for marine or internal navigation.

Patent granted to Sir Robert Seppings, *Knight, Somerset-house, London, for an improved construction of such masts and bowsprits as are generally known by the name of made masts and bowsprits.* Dated January 19, 1826.

The object of the patentee is to make large masts with small balk, in more numerous pieces, by which their cost will be considerably less than when made, as usual, of large Riga fir, in fewer parts, of greater dimensions.

The head and the heel of each of the masts of this new construction are to be made of the same shape, in order that they may be turned upside down in case of accident.

Masts of this description are to be formed of several pieces of balk, connected together by trennels, coaks, bolts, and hoops. When the mast is to be more than 33 inches diameter, the size of the balk is to be found by dividing its diameter by 4. The core of this mast is to be made of four pieces of balk of these dimensions, joined together by trennels, 1¼ inch in diameter, passed through them diagonally, 18 inches apart. As balk of this sort cannot be got of the whole length of the mast, the different lengths are to be so arranged that no two joints may lie in the same transverse section. 2dly, That they may be as nearly as possible at equal distances from each other; and 3dly, that they may be in those places over which the hoops are to pass; which hoops being 5 inches broad, each butt, where they meet, will be secured by half the breadth of the hoop, or 2½ inches of iron banding. The ends of these pieces of balk are to be united by coaks, 3 inches in diameter, and 6 inches long; and they are also to have coaks of about the same dimensions placed between them laterally. About this core eight other lengths of pieces, of the same thickness, are to be placed, two at each side, close to the first pieces; and four more lengths of pieces, cut of an angular shape, so that their sections will be similar to the quadrant of a circle, are to be placed at the four vacant angles, making the number of pieces, altogether, 16, at the transverse section of the mast; which mast being then shaped and tapered at each end, so as to fit it for being placed with either end uppermost, as first mentioned, and having iron bolts driven from side to side through all the pieces, at due distances from one end to the other, is to be further strengthened by having the hoops, before-mentioned, 5 inches broad, and ⅝ of an inch thick, placed round it at intervals 1½ foot apart from each other throughout. These hoops, for the thick part of the mast, are to be made each of two semi-hoops, with ends turned out, pierced, and tapped, for the admission of strong screws, by which they are to be drawn together tightly; but the hoops for the smaller and tapering parts, at the ends, are to be of the common kind, and when in their proper positions, are to be put on in the usual manner. It will easily be understood that the rule for arranging the ends of the pieces of balk for the core will also apply to those of the surrounding outside pieces, and that they are to be coaked together, both endways and sideways, in a similar manner, and to have their ends placed in the line of the hoops as before-mentioned. The patentee states that scarfs may be also used for connecting the ends of the pieces of balk, but that he does not recommend this method, thinking that by the coaks preferable.

The timber used for making these masts is directed to be well dried and seasoned before the pieces are put together; the holes for the trennels, and for the coaks, and the trennels and coaks themselves, are also recommended to be well painted, or coated with coal tar, previous to this operation.

The directions for making masts of the same sort, under 33 inches diameter, are nearly word for word the same as those already stated, and are repeated throughout in the specification. We shall, however, only notice the difference between the two methods, to avoid the needless tediousness of the other mode of explanation. To calculate the size of the balk for these smaller masts, the diameter of each is to be divided by 3, which will give the measure of the side of each piece. The iron hoops for them are to be of the same breadth as for the others, but are only to be ¼ of an inch in thickness, and the pieces of balk are to be fastened together likewise in the same manner, with trennels, bolts, and coaks; but an extraordinary direction is given for the dimensions of the coaks for joining the ends of the pieces of balk, which coaks for those smaller masts are ordered to be "3 *feet*" long, and 5 inches in diameter, which we suppose to be caused by some mistake, either of the patentee, or of the person who engrossed the specification.

The plan for making both ends of the mast alike, to admit of their being reversed in case of accident, has been before the public for many years, and, to the best of our recollection, was first recommended in print by Captain Packenham.

The general plan for connecting the pieces of balk seems to be chiefly deficient in the mode directed for uniting their ends, which gives no assistance in the longitudinal strains, which would be experienced in the bending of the masts in high winds; and the weakness which so many divisions across the mast, as the numerous meetings of the ends must occasion, would make those so inferior to common masts, that a great increase in their thickness could hardly compensate for this deficiency.

We are, however, much inclined to doubt the sufficiency of the common mode of masting altogether, or of any other which depends for its strength, in any respect, on the transverse resistance of the timbers of which the masts are composed, and are therefore led to give the preference, as yet, to the method proposed for this purpose by Mr. Guppy, (of which an account is given in our preceding Number, p. 185), which does not expose the mast to any transverse strain, and is also much cheaper than the contrivance of Sir Robert Seppings.

Patent granted to **John Antoine Teissier,** *of Tottenham Court Road, Middlesex, Gentleman, for improvements in steam-engines.* **Communicated to him by a foreigner. Dated September 15, 1825.**

The specification of this patent contains descriptions of boilers, of a singular construction, for steam-engines, and of machinery connected with a steam-engine, the chief effects of which latter are to convert the vertical motion given by the piston rod into one in a horizontal direction, and to afford a substitute for the beam.

The first boiler described is of a very complicated nature, and as it is, in fact, a combination of several complicated boilers, an account of a single one of this sort may perhaps lead better to an idea of the whole. This boiler we may suppose to be divided into two distinct parts, the first of which consists of a sort of cage, composed of several annular tubes, in a vertical position, with intervals about an inch broad between them, and connected at top and at bottom with two horizontal tubes, at right angles to them, into which they all open; the whole forming a cylindrical receptacle, which, being placed in a horizontal position, serves as a furnace or fire-place for the burning fuel, as well as a boiler, the intervals between the tubes admitting air to the fire, and the tubes themselves performing the double office of bars for the fire-place, and of a boiler to hold water. These annular tubes have likewise vertical tubes, passing from top to bottom, at their diameters, which form altogether a vertical grating, that divides the fire-cage into two equal parts, without interrupting the passage of the heat or of the air. This cage-like fire-place and boiler is surrounded at three sides and at the top by very thin flat boilers, which the patentee assimilates to *books* in their shape, those at the sides and end of the fire-cage being placed vertically, and that at the top being in a horizontal position. The front of the cage, or fourth side, is of course open, to admit the fuel, and is furnished with doors, both for itself and the ash-pit beneath it, like any other fire-place for the same purpose. The flat boiler at top has a flat flue running from end to end, through which the heat and smoke pass into the chimney, after having been made to circulate round the vertical boilers at the sides, in passages formed in the brick-work, which encloses the whole. The vertical boilers, and the cage boiler, communicate with the upper horizontal boiler by several short tubes, connected by flanches and screws, so that the passage through the whole, both for the water and the steam, may be uninterrupted.

The fire-cage is sustained by several horizontal bars, running from end to end outside, which are connected by a few annular bars or rings that enclose the whole, and form a second cage outside the first, but with very wide spaces between its bars.

This boiler, complicated as it is, only forms a part of that first described by the patentee, as no less than five of this sort are represented by him as being united for this purpose, having at top one flat boiler, of the sort mentioned, common to the whole; one thin vertical boiler at the end of the five fire-places, and six other thin vertical boilers for their sides, four of which constitute partitions to separate the fire-cages from each other. Any one of these fire-cage boilers can be taken away from the apparatus, without disturbing the action of the rest, the tubes, which connect them with the upper boiler, being furnished with cocks to close them on this occasion, and the external grating, that encloses each cage, being so contrived as to facilitate its removal.

The second boiler mentioned in the specification is formed at the bottom of a grating of tubes, bent into segments of circles, and having horizontal tubes at their ends and middle, so as altogether to resemble the lower portion of the fire-cage boiler just described, separated from the rest, and serving as it for a fire-grate. Above this tubular grate, and at right angles to it, a large horizontal tube runs from end to end, and two of the thin flat *book-like* boilers, before-mentioned, descend from its sides outwards, in angle of 45°, to the extremities of the sides of the tubular grate. A row of vertical pipes also ascend from the middle of the tubes of this grate to the large horizontal tube above them, and the thin sloped boilers are connected with it, and with the horizontal end tubes of the tubular grate, by short pipes. The large horizontal tube at top is divided into two portions horizontally, the upper half of which may be raised from the lower like a lid, to admit of it, and the tubes which open into it, being cleaned inside; and the two parts are connected together by flanches, with screws and nuts, when in operation. The tubular grating is, like the cage boiler, sustained by horizontal bars, supported by other bars, bent into segments of circles. The whole is enclosed in brick-work, having flues at the sides, through which the heat and smoke circulate round the thin flat boilers on their way to the chimney, on coming from the fire-place; of which those thin sloping boilers form the sides, the large horizontal tube the top, and the tubular grating the bottom, and which is furnished with doors and ash-pit like those of the other boilers. At the lower corners of the thin sloping boilers there are apertures, closed by stoppers fastened by screws, which admit of any sediment which may have formed within them being taken away, as it will naturally descend to their lowest extremities.

The third and last boiler described is composed entirely of the flat thin *book-like* boilers; but, besides the four of them which form its two sides, end, and top, two more, that intersect each other at right angles, pass diagonally across its upper portion inside, so as to resemble in their section a St. Andrew's cross; and a row of vertical tubes rises up in the middle of the grate, lengthways, from the ash-pit, to join them at their line of intersection. The vertical boilers at the sides descend below the grate as well as the tubes; or, what comes to the same conclusion, the fire-grate is placed between the two side boilers a foot or two above their bottoms, and is divided longitudinally by the row of tubes, which, however, have spaces between them, that admit the heat and air to pass freely on all sides. The whole apparatus is enclosed in brick-work, with flues round the sides, opening into a chimney, and the fire-place and ash-pit have their doors the same as the others.

The intersecting thin boilers, within the box-like space, formed by the others, divides that space into four longitudinal compartments, the lowest of which is the fire-place. From this the heat and smoke pass round at the end into the division at the left hand, and from that by the front into the compartment at the right hand, from which they proceed through the upper compartment, and under the horizontal boiler at top, to the flues outside the vertical side boilers, and from thence to the chimney.

All these boilers communicate with each other by tubes, which permit the water and steam to move from one to the other without interruption. The parts of the side boilers which are beneath the fire-place have apertures, with screwed stoppers, at their lower corners in front, for the removal of sediment; and of the row of vertical tubes all communicate with one horizontal tube at their lower ends, which is likewise furnished with a screw stopper, by taking off which a passage may be afforded for extracting obstructions.

The machinery connected with the steam-engine, described at the end of the specification, consists principally of a large iron quadrant, that serves instead of a beam, placed vertically in the plane of the working cylinder, with its angle, where its gudgeon is fixed, on a level with the bottom of the former. The lower and horizontal part of this quadrant is prolonged into two arms, one of which passes to each side of the working cylinder, where they are jointed to vertical rods, that descend from a cross piece placed on the top of the piston rod, to which cross piece they are also jointed; and from the upper end of the upright side of the quadrant, a horizontal rod passes to the crank of a fly wheel, which rod is jointed at each end, so as to admit of the required motions.

The alternately reversed vertical motion of the piston rod will, by this means, give a similar motion to the horizontal rod, so as to cause the fly wheel to revolve, and work the engines connected with its axle; on which axle an eccentric wheel is placed, by which the sliding valves of the steam-engine are opened and closed in the usual manner.

The patentee mentions that he considers the first boiler described best adapted for steam-boats, and the third sort more calculated for mills, or stationary operations.

The great complication of the boilers of the patentee would make them extremely expensive in their first cost, difficult to repair, or thoroughly to clean out, and very liable to leaks and derangement.

To understand more precisely their nature, we should consider the thin flat boilers, or portions of the boiling apparatus, separately from the tubular part, as their qualities are extremely different. These flat boilers would be liable to have their sides forced asunder by the steam, and burst, their length and straightness giving the steam the same mechanical aid, in this respect, that a weight receives in pressing down a long horizontal cord or chain, to the centre of which it is appended. It is true that the tubular boilers are, on the contrary, calculated to withstand great internal pressure from the steam, but that would not in any manner prevent the flat boilers connected with them from giving way; while they themselves, from their immediate contact with the burning fuel, would have their sides rapidly oxided and corroded.

The many circulations of the heat and smoke, or hot vapour from the fuel, through the numerous passages contrived for them in these complicated boilers, would only have the effect of making the water boil somewhat more quickly in the first instance, but after this, would add little to its temperatnre, as it is evident that every foot of space through which this vapour passed beyond that in which it would naturally have given off the excess of its heat, above 212°, to the water (which is no great distance) would be traversed to no purpose, as it must ultimately pass from the boiler at least as hot as the water within it. We should also take into account, that combined heat can be very little transmitted, either sideways or downwards, and that multiplying passages for such transmissions solely, must occasion a waste of apparatus, and increase of derangements and repairs.

It will be a question, how far the change of position from the upright to the horizontal, and the more numerous lateral communications, can exempt the tubular fire-cage of the patentee from being identified with the tubular fire-cage boiler of Mr. Theodore Paul, to whom a patent was granted in May, 1824, of which an account is given in vol. I. p. 190, of our present series; at the end of which will be found some further observations on tubular boilers, to which we beg leave to direct the attention of our readers.

Patent granted to WILLIAM TURNER, *of Winslow, Cheshire, Saddler, and* WILLIAM MOSEDALE, *of Park-street, Grosvenor-square, Middlesex, Coach-maker, for an improvement on collars for draught horses.* Dated April 2, 1825.

OF this collar the *wale* is to be first made of stiff leather, and to be stuffed with straw, and is to have a piece of leather attached along its side, to which the cloth is to be fastened that is to form the cover of the rest of the collar, which cover is to be stuffed with rye straw. It is in the shaping of this latter part that the chief point of the contrivance consists, that is to be secured by this patent, and which is declared in the specification to be effected by bringing "the stuffing round on the inside of the collar so as to cover it, by which a tension is obtained that prevents the collar from bending backwards, and affords a soft or elastic resisting surface, to bear against the neck and shoulders of the horse." The inside of this body part of the collar is to be laid over with a layer of curled hair, and over that another layer of corded flocks is to be placed, and the whole is to be covered with soft leather, to be fastened on by pasting and sticking, as commonly done; and the finishing of all its parts is then to be performed in the manner usually practised for collars of the description required. A front and back view of this collar, and a cross section of its thickest part, is given in the drawings which accompany the specification.

FRENCH PATENTS.

Brevet d'Invention for fifteen years, granted to MADAME CHAUVEAU, *of Montlouis, Widow, for a new manner of manufacturing rice from potatoes.* Dated August 1, 1806.

THE potatoes, after being taken out of the water (in which they have been boiled, we suppose), are left to drain for a night, after which they are taken in lumps, and forcibly passed through a brass cullender or sieve, held above a tin plate or tray, having a border round it about an inch high. The substance of the potatoes pressed through the cullender falls, like snow, on the tin tray, and is permitted to fill it as high as the top of the border.

The trays filled in this manner are carried to an oven, which should be equally hot as for bread. When the substance is done enough will be known by its becoming detached from the trays; then it is to be drawn from the oven, and beaten a little in a large mortar; and when it is reduced to bits about the thickness of a macaroon, it is to be passed into a mill of the sort used in making snuff, where the pieces are divided unequally. The matter having undergone this sort of grinding, is passed through different sieves, to divide it into rice of three species of thickness, and into rice flour.

The idea of preparing potatoes in this manner originated, we believe, with M. Pictet, of Geneva. In the Journal of the Lyceum of Arts of Paris, in 1796, M. Grenet has given an account of a good process for obtaining granulated potatoes, copied from that of the professor mentioned, and has described a very convenient apparatus for the purpose; a print of which, with a translation of the account of the process, will be found in the third volume of our first series.

The process might be advantageous for preparing a useful and wholesome article for sea store, that would keep better than common potatoes, and not be liable to vegetate; but as for the notion of converting potatoes into rice, or into flour, or into any thing else extraneous to their nature, which has been so often proposed, we believe it to be entirely chimerical, and either to originate in self-deception, or in a culpable intention of adulterating rice with an article made to resemble it in some respects, but which possesses nothing of its delicacy and freedom from flavour, and contains much more mucilaginous matter, and much less of a farinaceous nature.

We think M. Grenet's process in all respects better than that of Madame Chauveau, except as regards the baking; though it is most probable that a stove would dry the granulated potatoes better than any oven, and with much less risk of either burning or scorching them.

Brevet d'Invention for five years, granted to M. Boivin, *of Paris, for a method of making, with the skin of the belly of the cuttle fish, called* Margatte, *transparent leaves, imitating those of horn, proper for the construction of lanterns, and for the use of light-houses.* Dated September 7, 1816.

The material with which these transparent leaves are made is taken from the belly of the cuttle fish, commonly called the *margatte*, in which is found the cuttle fish bone employed in the arts. This fish is very common on the coasts of France, and particularly on those of the ancient province of Brittany.

In the time of peace the English catch these fish in the course of July and August, a time when it is easy to procure them in abundance; at all other seasons they can only be had with difficulty, and in small quantities.

THE MODE OF PROCEEDING.

After having taken off the skin of the belly of the cuttle fish, which is commonly of the thickness of a finger, the pieces obtained are directly washed in sea water, and left to dry. In this state they are soft to the touch, except at the inside, which has more consistence, and is to form the leaf; at the end of some days, when it is warm weather, they become soft; then they are piled up in casks, in which they may be preserved for some time.

To form them, many tubs or backs will be necessary, in which they are to be washed with soft water, which must be continually renewed, until they become clear; and it is only after the most perfect washing that they are rendered transparent.

When they are very clean, they are hung up in a stove, where they are kept much extended by hooks, of wood or of iron; then the stove is smartly heated to melt the grease from them, and in proportion as this grease diminishes, they become thin and transparent.

When the leaves are thus deprived of their fat, they are soaked in clear water for some days; they soften, and if they still contain any grease, they are again put in the stove. These operations are repeated until the leaves are thin enough, and are not brittle, which is effected by melting and completely removing the grease.

The size of the leaves vary as the fish is larger or smaller.

To make them stiff, and give them a fine polish, they are pressed between well polished plates of copper, after having laid over them a varnish composed of turpentine, prepared with spirit of wine.

This preparation is made by melting, over hot embers, or on the water bath, turpentine in spirit of wine, which becomes evaporated by the heat. Then it is passed through linen, to render the varnish clear and pure; and if in the mixture of the turpentine and spirit of wine some pieces of horses' hoofs be dissolved, the leaves of cuttle fish skin will acquire an odour of horn, which they will even preserve while they are being burned.

The last direction, relative to the horse hoofs, must not be taken literally, as they, in fact, could not be dissolved in this mixture; but perhaps the infusing them in it may have the effect, which at any rate is in no way desirable where deception is not intended.

LIST OF NEW PATENTS.

JOHN BILLINGHAM, of Norfolk-street, Strand, civil engineer, for an improvement or improvements in the construction of cooking apparatus.—Dated April 18, 1826.—(*Two months to enrol specification.*)

JAMES ROWBOTHAM, of Great Surrey-street, Blackfriars Road, Surrey, hat manufacturer, and ROBERT LLOYD, of No. 71, Strand, for a certain method of preparing, forming, uniting, combining, and putting together, certain materials, substances, or things, for the purpose of being made into hats, caps, bonnets, cloaks, coats, trowsers, and for wearing apparel in general, and various other purposes.—Dated April 18, 1826.—(*Six months.*)

THE

REPERTORY

OF

PATENT INVENTIONS, &c.

No. XII. JUNE, 1826.

Specification of the Patent granted to JOSEPH FAREY, *of Lincoln's Inn Fields, Middlesex, Civil Engineer, for an improvement in lamps.* Dated July 16, 1825.

WITH AN ENGRAVING.

TO all to whom these presents shall come, &c. &c. *Now know ye*, that in compliance with the said proviso, I, the said Joseph Farey, do hereby declare that the nature of my said invention, and the manner in which the same is to be performed, are particularly described and ascertained in and by the sheet of drawings hereunto annexed, and by the following description thereof, (that is to say) :—My improvement in lamps consists in applying the direct action of a descending weight, or the direct action of a spring, to press upon and diminish the capacity of the oil chamber or reservoir, which contains the store of oil, or other fit inflammable fluid, with which the flame of the lamp is to be maintained. In order, by means of such compressure and diminution of the capacity of the said oil chamber or reservoir, to express or force out the oil or other fluid therefrom, and raise it through the supply pipe, and cause it to exude slowly through a small and properly adjusted hole at the upper end of such supply pipe, so as to abundantly feed and supply the wick or burner of the lamp. The said oil chamber or reservoir may be placed in the pedestal or base of a table lamp, or in the usual situation for the reservoir of any other kind of lamp, whereof the oil chamber is on a lower level than the flame of the wick or burner; and such oil chamber or reservoir may be a bag of leather, or any other flexible material or fabric, with a moveable top or bottom, or it may be composed of or lined with metal of any kind, and fitted with a moveable stopper or piston. The said oil chamber or reservoir being in either case adapted to admit of enlargement or diminution of its capacity, in order to fill it with the store of oil or other fluid in the first instance, and to afterwards express that oil or other fluid gradually from it, to supply the burner. The quantity of oil or other fluid thus supplied being more than is consumed by the flame, the surplus is returned, through a waste pipe, to a store case surrounding the aforesaid oil chamber or reservoir, and the oil or other fluid collected in such store case may, from time to time, be returned or drawn into the oil chamber to fresh charge the same, by only drawing up the aforesaid compressing weight or spring, which is applied to act upon the moveable top or bottom of the said oil chamber or reservoir.

Fig. 1 (Pl. XII.) represents a sectional view of one of my improved lamps, wherein A A A A represents the oil chamber or reservoir for oil, consisting of a flexible cylindrical bag of leather, or other fit material, as impervious and insensible to the action of oil as may be; this bag, A, being made up in a cylindrical form, by an oil-tight seam, and the bottom and the top of this cylinder of leather, or other flexible material, being retained and pinched in an oil-tight manner between two conic surfaces of brass, or other fit metal, marked B B, which will be further mentioned herein. C C are a series of circular weights, of lead or other fit metal, perforated in their centres so as to slip freely on to, and be retained in their places, by the tubular stem, D D, affixed to and rising up from the metal top, B, of the bag, A. The tubular stem, D, has, soldered or otherwise fixed on its top, a perforated cap, *a*, through the perforation in which cap there freely slides the cylindrical stem or lower part, E E, of the rack F. The said cylindrical stem, E, being furnished at bottom with a button or head, *b*, by means of which button, *b*, acting against the cap, *a*, the said rack, F, is enabled, by the action of its pinion, G, and of its milled thumb heads, H H, to draw up the said weights, C, and to distend or again enlarge the capacity of the bag A, when the operation is required of charging or filling the said bag with oil; which said charging of the bag is effected out of the store case, I I I, &c. made almost in the form of a wine bottle, of tinned iron or of any fit metal, tightly soldered or otherwise jointed, and made oil-tight in all parts except its top, on which there is affixed the oil tray, K K; through a hole in the bottom of which oil tray, K, the rack, F, freely passes. It has also the waste hole, *d*, in its bottom, for letting oil down into the store case, I; through it there also passes the supply pipe, N, which will be further mentioned herein; and on the said oil tray bottom there is also affixed, and rises up therefrom, the waste pipe, L L, which has a screw plug, *f*, in its top; which screw plug is sometimes removed, when a supply of oil for the lamp is to be poured (from a feed can) through the said waste pipe, L, which has a hole, *e*, in its side within the tray, for letting out the oil, and permitting it to drop through the waste hole, *d*, into the said store case, I; or, at other times, as convenience may dictate, the supply of oil for the store case, I, is poured at once from the feed can through the waste hole, *d*, and a cork or stopper is applied occasionally to stop this hole. The oil from the store case, I, is admitted into the bag, A, through the bag valve, M, during the drawing up of the weights, *c*, and the distending of the bag, as has already been mentioned herein; and the oil is again expelled from the said bag, A, through the supply pipe, N N N N N, by the action of the said weights, *c*, or of a spring, as will be further mentioned herein.

The escape of the oil from the top of the said supply pipe, N, into the oil cup, T T (shown also detached in fig. 4), and the further progress of the oil to the wick tubes, O O O O, being regulated by an exceedingly fine or small hole, *g*, either drilled through the top of the screw plug in the top of the said supply pipe, N, or else, for securing this delicate hole from external injury, and to prevent the occasional spirting up the oil therefrom, a deep notch is filed in the side of the said screw plug, and the small hole is drilled up into this notch. A strainer of fine gauze is stretched and tied over the lower end of this screw plug, in order to prevent the entry of dust or impurities, which might choak the small hole.

The oil thus supplied to the said oil cup (through the small hole, *g*), flows to the wick, through holes or slits in the outer one, *h h*, of the wick tubes, *o*, in the ordinary manner of Argand's lamps, and the waste or superabundant oil escapes from the said oil cup, T, through the aperture, *i*, in the screw plug, *f*, in the top of the said waste pipe, L. The hole, *i*, should be on a somewhat higher level than the said holes or slits in the outer wick tube, *h*, in order that some oil may always rest in the oil cup, for the perfect supply of the wick.

The pipes L and N act as supports for the burner and its apparatus; and being each furnished with a tight fitting screw collar or union joint, P P, they can, by this means, be detached whenever the cleaning or reparation of the lamp may render this necessary. Studs are affixed upon these pipes L and N (but not shown in the drawing), which support the axis of the pinion G; or this axis may be supported at *q q*, nearer to the pinion. After the operation of drawing up the weights, C, by means of the pinion, G, and the rack, F, the pinion is to be turned the contrary way, in order to lower the rack, and prevent its causing any obstruction to the free current of air within the circular wick tubes, O; the cylindrical stem, E, and button, *b*, of the rack for this purpose, sliding freely down into the tubular stem, D, which is attached to the bag top, as already mentioned. Q Q is the glass chimney. The metallic bottom, B B, of the bag, standing on the short or stub feet, *k k*, is fastened down to the bottom, I I, of the oil-tight store case by two screws (which are seen also in figs. 2 and 3), and the heads of these screws are rendered oil-tight by means of small cups of tin, *l l*, soldered over them. The inner bottom, *m m*, of the outer or ornamental case of the lamp, supports on similar stub feet, *n n*, the bottom of the said store case, I, and a pair of screws serve in like manner for attaching the whole together: but this attachment of the parts of my lamp may be made in any other fit and convenient manner.

Fig. 2 is a section, and fig. 3 a plan, which are intended for more clearly showing the manner in which the bottom of the bag, A, is pinched and held between the outer cone, B (by means of the screws, *p p p*), and the inner cone, S, composing the metallic bottom of the said bag. The upper end of the bag is secured to its top in a similar manner. The partial collapsing of the middle parts of the bag, A, during the drawing up of the weights, C, occasioning an imperfect filling of the bag with oil, may be prevented by using within the bag a helically coiled wire, having one of its ends attached to the metallic top, and the other attached to the bottom of the said bag. Instead of a cylindrical bag with metallic ends, such as has been described herein, the ends of a leathern or other bag may be sewed or tied up, in any fit and oil-tight manner, for the oil chamber of my improved lamp, or the skin, the bladder, or other vessicular parts of animals, may be used for the like purpose.

Fig. 5 represents the mode of applying the direct action of the descending weights, C C (such as have been already described herein), within the metallic cylinder, A A A A, truly formed and polished inside, in order to cause the piston, U U, to press upon and diminish the oil chamber, U U, A A, beneath it, and fount up the oil therefrom through the supply pipe, N N N N, and its small regulating hole at top, for the supply of the burner of my improved lamp, as already has been described herein, and as the corresponding letters of reference on the same or similar parts in the several figures will serve to explain. The piston, U U, is furnished with a cupped leather disk, *r r*, both above and below it, in order the better to secure an air and oil-tight fitting during the drawing up and during the sinking down of the said piston. When, instead of weights, springs are used for pressing down the moveable tops of my oil chambers, A A A A, or U U, A A, in figs. 1 and 5, the said springs may take their purchase or abut against the contracting parts of the store cases, I I; and when such springs act upwards, they may take their purchase against the bottoms of the said store cases, I I; and so in case of springs, either spiral, helical, or otherwise, being used to compress an end or a side of an oil chamber, in order to fount up oil therefrom through a supply pipe, and its small regulating hole for the supply of my improved lamps, such springs may take their purchase against the corresponding end or side of the surrounding store cases; or in any other fit manner may such springs be counter-acted, and be wound up or bent.

Lastly, my claim under the hereinbefore in part recited patent is, for applying the direct action of a descending weight, or the direct pressure of a spring, to the raising up of oils, or other inflammable fluids, in sufficient quantities, regulated by the smallness of the holes through which such oil or fluid has to pass in its ascent to the wicks of my improved lamps.

In witness whereof, &c. &c.

Specification of the Patent granted to GEORGE DIGGLES, *of College-street, Westminster, Middlesex, Gentleman, for an improved bit for riding horses, and for horses used in single and double harness.* Dated August 19, 1823.

WITH AN ENGRAVING.

TO all to whom these presents shall come, &c. &c. *Now know ye*, that in compliance with the said proviso, I, the said George Diggles, do hereby declare that the nature of my said invention, and in what manner the same is to be performed, are particularly described and ascertained in and by the drawings hereunto annexed, and the following description, (that is to say):—

The ordinary mode of driving from the curb is often attended with serious inconvenience, from the irritation occasioned by a continual action of the lever, which frequently lacerates the mouth of the horse, and so much distresses him as to cause a rejection of his food, and sometimes to injure his jaw bone. The constant use of the curb renders the mouth callous, and in case of a false step the check loses much of its effect on a journey; the mouth, being kept partially open, becomes parched, and in dusty weather annoyed by dust, tending to the injury of the animal's health and spirits.

My improved bit is therefore designed to operate in the same way as a common bit with a curb chain, for ordinary riding or driving, and also to afford the ready means of exerting a very considerable purchase upon the horse's mouth when occasion shall require it, without getting off the horse, or dismounting from the carriage. This improvement consists in a sliding piece, with a ring attached to each cheek of the bit, to which ring the riding or driving rein is to be connected in the usual way; and when it is found necessary to exert a considerable force in curbing the horse, the pulling of the rein will draw the slider to or towards the bottom of the cheek of the bit, and give an increased leverage thereto.

Fig. 6 (Pl. XII.) of the annexed drawings represents a horse's head, with the improved bit, as it would appear on a side view in the ordinary driving or riding position. The dotted lines show the position of its parts when the rein is pulled with considerable force. Fig. 7 is a front view of the improved bit, and the following figures are parts of the bits detached. Fig. 8 exhibits the side of the bit, in the position shown by the dotted lines in fig. 6, and the following description, referring to figs. 6, 7, and 8, will render the improvement perfectly intelligible.

a is the driving or riding rein, attached to the ring *b*, which, instead of being fixed to some particular part of the cheek of the bit (as is the usual way), is in this improved bit attached to a sliding piece, *c*. A spring, *d*, acts upon the sliding piece, and keeps it and the spring, *b*, up to that part of the cheek which is near the mouth piece, *e e*, (as seen in fig. 7); and the purchase of the lever at this point being small, the driving or riding rein will act in the same manner as the ordinary rein attached thereto; but when it becomes necessary to exert an extraordinary power upon the horse's mouth, the rein, *a*, being pulled back with considerable force, will cause the cheek of the bit to move out of the perpendicular position, and the sliding piece, *c*, with the ring, to slide downward towards the lower part of the cheek, as seen in fig. 8, and also by the dotted lines in fig. 6. To prevent the ring and slider from being drawn too low, a stop, *z*, is to be placed on the bit used for a saddle horse, but the bar at the bottom of a driving bit, as shown in fig. 7, operates as a stop. By these means the rider or driver has obtained so much purchase upon the mouth that the animal will yield to the pressure of the curb; but as the tension of the rein is relaxed, the cheek of the bit resumes its first position, and the spring, *d*, draws up the sliding piece, *c*, with the ring, *b*, and rein, *a*, to their ordinary places, as in fig. 6.

Fig. 22.

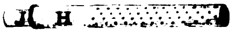


Fig. 21.

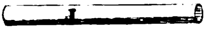


Fig. 20.

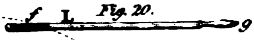


Fig. 19.

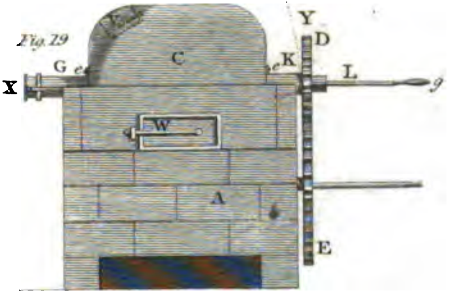
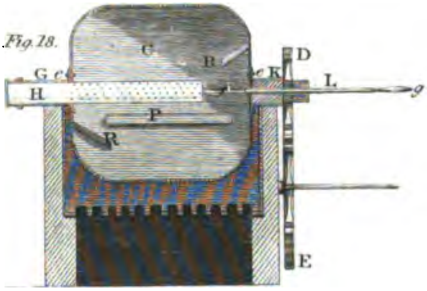


Fig. 18.



g. 6.

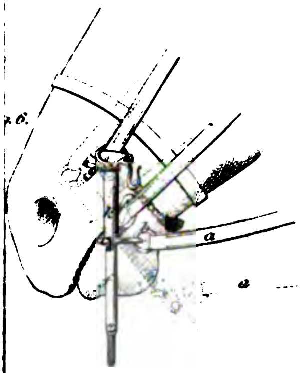
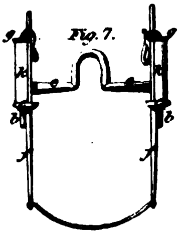


Fig. 7.



Having described the operation of the improved bit, I proceed to show the construction of its several parts. Near the upper extremity of each cheek, *ff*, I affix a piece, *g*, which I call the cap, shown in two positions, detached, at figs. 9 and 10. This cap may be made fast to the cheek by screws, rivets, or otherwise. On the under side of the cap a piece projects, with a hole perforated through it, and into this hole the upper end of the flat helical spring, *d*, is passed, as shown in fig. 11. At the lower end of this spring a swivel, *i*, is attached (shown by itself in fig. 12), and to the swivel the sliding piece, *c*, is connected by a small screw. (Both the latter are shown in fig. 13.) In order to enclose the spring, and shield it from dirt and dust, a cover or box, *k*, in figs. 6, 7, and 8, is placed on each cheek of the bit, which cover or box is also shown detached in fig. 14. For the convenience of occasionally oiling or exchanging the spring, this cover or box, *k*, is made to slide up and down in grooves, formed in the opposite edges of the cheeks, in the manner shown at *l*, in fig. 15; or the cover or box, instead of sliding in grooves, may be fastened to the edges of the cheeks by screws, to be taken out and replaced as occasion may require. The grooves are made in the upper parts of the cheeks, widened so as to form the back of the box or cover for the spring; and as this widened part extends only the length of the spring in its quiescent state, and of part of the swivel (being less than half the whole length to the stop in the cheek of the riding bit, or to the bar of the driving bit), it follows that the cover may be taken off as well when slided down in the grooves as when unscrewed, and the upper end of the spring may then be withdrawn from the hole in the cap, *g*, and by taking out the screw of the sliding piece, *c*, the spring may be removed, cleaned, and replaced, or another, of greater or less elastic force, substituted, as circumstances may require. When these improved bits are used with double harness, I recommend the sliding pieces which act upon the inner cheeks of the bits to be in the form shown in fig. 16, having the ring on the side of the inner sliding piece of each horse's bit, for facilitating the draft of the cross reins.

By the above explanation I conceive, that the nature, principles, construction, and advantages of my improved bit, will be fully explained; but I wish it to be understood that I do not confine myself to any particular dimensions, and am aware that several parts may be slightly varied without deviating from the principle of my invention; and I do not claim the mechanical contrivances above described as new in themselves, but only as applied to a bit; which contrivances being perfectly new, to the best of my knowledge and belief, and never before used in this kingdom, I hereby claim as my patent right, and the exclusive use of the same.

In witness whereof, &c. &c.

Specification of the Patent granted to RICHARD EVANS, *of Bread-street, Cheapside, London, Wholesale Coffee Dealer, for a method or process of roasting or preparing coffee, and other vegetable substances, with improvements in the machinery employed, such process and machinery being likewise applicable to the drying, distillation, and decomposition of other mineral, vegetable, and animal substances; together with a method of examining and regulating the process whilst such substances are exposed to the operations before-mentioned.* Dated February 28, 1824.

WITH AN ENGRAVING.

TO all to whom these presents shall come, &c. &c. *Now know ye*, that in compliance with the said proviso, I, the said Richard Evans, do hereby declare the nature of my said invention to consist in abstracting the aqueous and acidulous particles from coffee without volatilizing the essential or other oils contained or formed therein, which said invention is performed by means of certain improved machinery hereinafter described. And in further compliance with the said proviso, I, the said Richard Evans, do hereby describe my said improved machinery, and the manner in which I perform my said process therewith, by the following description thereof, reference being had to the drawing annexed, and the figures and letters marked thereon (that is to say):—

DESCRIPTION OF THE DRAWING.

Fig. 17 (Pl. XII.) represents an end elevation of part of my said improved machinery. A is a fire, or common furnace bars, built up in brick: B is the chimney to the same: C is a hollow vessel, cylindrical, or of any convenient form, which hereafter I will call and refer to as the roaster, made of sheet iron or other suitable material, single or double, (that is) if cylindrical, one cylinder within the other, turning on axes which rest on bearings at each side of the brick-work. D is a small spur wheel, attached to one axis of the roaster, and E is a large cogged wheel, working into it, which large wheel is fixed to a shaft, which shaft is intended to give motion to the apparatus, or to any series of roasters that may be required, and which shaft I therefore call the motion shaft. F is a cover of sheet iron, or other metal, which shuts down over the roaster, to prevent the escape of heat from the fire, and moves on hinges at *a*. As I principally apply my said invention to the roasting of coffee, I shall confine myself in the following description, in the first instance, to the manner of performing this particular process. This figure then represents the general appearance of what, for this particular purpose, I shall call a coffee roaster. It is well known that when raw coffee is put into a closed vessel, over the fire, a steam or vapour is instantly generated, and the main object of this invention, as applied to roasting coffee, is to let this steam escape without allowing the oil to become volatilized. Fig. 18 represents a front section of my said invention, showing how this is effected. The axes of the roaster, C, are hollow, and do not pass through the roaster, but are fixed, one at each end of it, by means of flanges, *e e*. Through the axis I introduce a copper, or other hollow tube, H, which should extend into the roaster about two-thirds of its length, and should be perforated with a number of small holes, and closed at the inner end. This tube serves as a chimney to carry off the steam before-mentioned. Through the axis, K, I introduce a rod, L, with a cavity, *f*, at one end, and a handle, *g*, at the other. This is what I call an examiner; the cavity is always filled with coffee, and when drawn out with the cavity upwards, which by this arrangement may be done, as will be seen, without stopping the rotation of the roaster, shows the exact progress made in the roasting of the coffee, and its precise colour. P is a ledge in the inside of the roaster, to disturb the coffee, and is similar to those used in the common coffee roaster; but R R are two diagonally placed ledges, which constitute a part of my said improvements, since, from their novel position, they disturb the coffee much more effectually, and keep constantly turning over the berries or other substances from the sides into the centre, where the greatest heat is generally kept up, and thus exposes all the contents, by turns, to the same temperature. The use of the standard, S, and the handle near it, will be described in the next figure. The cover, F, is omitted both in this figure and in fig. 19, in order to make the drawing less confused. Fig. 19 is a front elevation of my said invention. V is a trap-door opening, through which to pour the material into the roaster, and empty it again when roasted. W is the fire or furnace door: X is a swivel or ring, turning in an axis on which the axis, G, of the roaster turns, and is used for the following purpose (that is to say):—When the coffee is of a proper colour, and fit to remove from the fire, the end, K, of the roaster, C, is raised in the direction of the arrow, and turned completely over, describing the arc, Y Z, when the axis, K, will come exactly into the bearing on the upper part of the standard, S, the axis, G, being supported in the ring at X. When in this situation, if no motion can be given by the aforesaid motion shaft, the crank handle, shown in this figure, must be applied to the square on the end of the axis, K, beyond the spur wheel, D, and thus the roaster is to be kept rotating (though off the fire), till the coffee is emptied into a vessel, to be conveyed to a skiff or proper place to be cooled. Fig. 20 is a separate view of the examiner. Fig. 21 is a plane copper tube, not pierced with holes, and small enough to slide easily into the tube, H, for a purpose hereinafter explained. This tube should be open at both ends. Fig. 22 is a representation of the tube, J, when slid into the tube, H. Having now described the various parts of my said improved machinery, I will next proceed to describe the process to be effected by means thereof, as regards the roasting of coffee. The apparatus being arranged as shown in fig. 18, the trap door, V, must be opened, and through it the roaster, C, must be filled half or two-thirds full of raw coffee. Then shut the door, and a fire having been lighted in the furnace below, put the motion shaft in action. By this means the roaster should be gently turned round, and very soon a dense steam or vapour will be seen to issue through the axis G. This will continue for some time, and when it begins to become unctious or dry, the plane tube, J, should be partly slided into the tube, H, and by this means the holes in the tube, H, will be partly stopped up, and this tube, J, should be pressed further in, from time to time, as the steam becomes less dense. There is one particular period of the operation which can only be learned by practice, when the aqueous and acidulous particles, or what by the action of the fire becomes acidulous or acetous, having been evaporated, the oil contained or formed in the coffee will begin to volatilize, and escape by the same passage as the steam, and in the form of vapour; and it is at this critical moment that the tube, J, should be pressed partially or quite into the tube, H, thus lessening or preventing any further escape of the oil, and quickening the operation. One mode by which I have been able to ascertain this critical point of time, when the oil begins to volatilize, has been by holding a piece of common slate before the end of the tube, H, when so long as water, sap, acidulous or other vapour only, escapes, it condenses on the slate, and shows itself to be such; and as soon as oil escapes, it also condenses, and is equally distinguishable by its ordinary, greasy, and glutinous properties. At this critical moment before alluded to, and some time previously, the examiner should be consulted, to ascertain the state of the colour of the coffee, and other signs, which practice only can teach, indicative of the proper degree of roasting being effected. When this degree is obtained, the roaster should at once be turned over on to the standard, S, as before described, and by means of the handle, or some other contrivance connected with the motion shaft, the roaster should be kept in motion until the coffee is discharged into a vessel, to be conveyed to the cooler, and a fresh supply of raw coffee put into it, and the process renewed as before. It should here be observed, that the examiner serves as a safety valve in case of accidents, when all the holes in the tube, H, are stopped up by the introduction of the tube, J, and for this reason, therefore, it should be allowed to move freely in and out of the axis, K, and should not be fastened in. Now whereas by means of connecting machinery, a series of any number of the aforesaid apparatus for roasting coffee, or other purposes, may be arranged on the principle hereinbefore described; and it is obvious that the improved machinery hereinbefore described is equally applicable to malting and drying of corn, as also to the purposes of distillation and decomposition of mineral, vegetable, and animal substances; but that for which I propose to maintain exclusive right and privilege is, the improved machinery, as hereinbefore described, to be particularly applicable to roasting coffee, whether the same be applied to that or other purposes; and which said improved machinery I do hereby declare to consist of the following improvements (that is to say):—First, in the hollow axles G and K; secondly, the tubes H and J; thirdly, in the diagonal ledges R R; and lastly, in the examiner L, which serves the double purpose of examiner and safety valve. And such improved machinery, for the purpose aforesaid, and applicable to the other purposes aforesaid, being, to the best of my knowledge and belief, entirely new, and never before used in these kingdoms, I do hereby declare this to be my specification of the same, and that I do verily believe this my said specification doth comply in all respects fully, and without reserve or disguise, with the proviso in the said in part recited letters patent contained, wherefore I do hereby claim to maintain exclusive right and privilege to my said invention.

In witness whereof, &c. &c. &c.

Specification of the Patent granted to THOMAS HANCOCK, *of Goswell Mews, Old-street, St. Luke's, Middlesex, Patent Cock Manufacturer, for an improvement or improvements in the preparation, or in the process of making or manufacturing, of ropes or cordage, and other articles, from hemp, flax, and other fibrous substances.* Dated March 15, 1825.

TO all to whom these presents shall come, &c. &c. *Now know ye*, that in compliance with the said proviso, I, the said Thomas Hancock, do hereby declare that the nature of my said invention, and the manner in which the same is to be performed, is described and ascertained as follows (that is to say):—The nature of my said improvement or improvements in the preparation or in the process of making or manufacturing of ropes or cordage, and other articles, from hemp, flax, and other fibrous substances, consists in the mixing or covering the said fibrous substances, when they are formed into yarns, strands, ropes, or cordage, or woollen, cotton, or silk threads, with a liquid which I shall hereinafter more particularly describe, so as to render the said substances, when formed into ropes, cordage, or other articles, less liable to injury from air or moisture, and thereby increasing their durability. The liquid I use for the purpose hereinbefore mentioned is brought into this country, and is said to be the juice obtained from certain trees which grow in several parts of South America, the East Indies, and other places abroad. It is stated in Mr. William Nicholson's Translation of Fourcroy's General System of Chemical Knowledge, that this juice is obtained in South America, from a tree called the Hevœa. The juice or liquid I have made use of was obtained from South America, and from my own experience I find that the said juice or liquid, when exposed to the open air in the sun, or in a warm room, becomes inspissated or dried, and then forms a substance exactly resembling, and which I believe to be identically of the same nature, and to possess the same properties, with the substance manufactured into bottles, and other articles, and well known by the names of caoutchouc or India rubber, or elastic gum. In colour and consistence the said juice very much resembles cream. The application of the said liquid to the aforesaid fibrous substances, when formed into yarns, strands, ropes, or cordage, or woollen, or cotton, or silk threads, is easily effected, and to this end I employ a process (as being a convenient one) exactly similar to that employed by rope-makers in making tarred ropes, or in saturating the strands of the rope with tar, and which process is well known to persons employed in rope-making, with this difference only, that I employ the said liquid instead of the tar, but the said liquid is not heated, and the strands, yarns, or threads, must be separated whilst in their wet state, or they will become more or less united. If it is wished to increase the quantity of the liquid on the yarns, threads, or ropes, I effect this by repeated coatings, until the required thickness is obtained, laying it on always just before the previous coating is quite dry, and keeping them separated. The substances having been thus saturated or coated with the liquid, I then place them in a warm room, or in the open air, until the evaporable part of the liquid has been completely dissipated. I lastly declare that my invention consists in the application of the liquid hereinbefore described to ropes or cordage, and other articles, such as woollen, yarn, silk, and cotton thread, or to ropes, cordage, strands, yarns, or threads made from other fibrous substances, so as to render the ropes, cordage, strands, yarns, or threads, less liable to injury from exposure to air or moisture.

In witness whereof, &c.

A very interesting paper has been published by Mr. Faraday, in the last Number (XLI.) of the Journal of the Royal Institution, on caoutchouc in its primary state, or liquid sap, as first drawn from the tree or vine which produces it, and the inspissation of which affords it as we are accustomed to use it.

This liquor is a pale yellow, thick, creamy-looking substance, with a disagreeable acescent odour, like that of putrescent milk, a very little heavier than water, and which also resembles milk in being coagulated by air, alcohol, and acids; but the alkalies produce no effect on it but the causing it to evolve a very fetid odour, and heat causes it to coagulate. The coagulated part is the same when dry as the solid caoutchouc, and in no respect differs from that produced by the natural separation of the liquor. But the principal novelty in Mr. Faraday's paper consists in the discovery made by Mr. Hancock, as stated in his specification, that the liquid caoutchouc may be washed by agitation with water, so as to be entirely deprived of colour; after which, on being dried, it is perfectly transparent, which appears best in a plate a tenth of an inch in thickness, and it then resembles a piece of clear strong jelly. It is also remarkable, that body colours, rubbed very fine with water, and mixed with the liquid caoutchouc in a somewhat diluted state, produced, on coagulation, perfectly coloured specimens, as was proved by trials with indigo, cinnabar, chrome yellow, carmine, and lake. But perhaps a fact of more importance than these is the miscibility of the liquid caoutchouc with water, with no other change than mere dilution, in which state it is *much more easily preserved;* portions of it left over water for twelve months underwent no change, except the production of a slight film on its surface, and were still as miscible with water as at first, and when coagulated equally elastic.

1000 parts of the liquid caoutchouc, or original sap, were found, by Mr. Faraday, to contain—

(Solid) Caoutchouc	317·0
Albuminous precipitate	19·0
Bitter colouring matter, a highly azotated substance (yielding a strong odour of ammonia)	71·3
Wax	
Substance soluble in water, not in alcohol	29·0
Water	563·7
	1000·

Mr. Faraday concludes his paper by the following enumeration of publications relative to caoutchouc, to which we have added a few other references.

1751. De la Condamine, on an Elastic Resin, &c. discovered at Cayenne, by M. Fresman. *Mem. de l'Acad. Royale,* 1751, pp. 17, 319.

1763. MM. Herisant and Macquer, on Solution of Caoutchouc. *Mem. de l'Academie,* 1763, p. 49.

1768. Macquer, on dissolving Caoutchouc, &c. *Mem. de l'Acad.* 1768, pp. 68, 208.

1781. Bernard, Memoir on Caoutchouc, &c. *Journal de Physique,* vol. xvii. p. 265.

1790. Fourcroy, on the Sap furnishing Elastic Gum.

Ann. de Chim. vol. xi. p. 225; *Repertory of Arts*, vol. viii. p. 445; and *Connais. Chim.* vol. viii. p. 36.

1791. Grossart, on making Instruments of Gum Elastic, &c. *Ann. de Chim.* vol. xi. p. 143; also *Repertory of Arts*, vol. i. pp. 70, 131.

Fabbroni, on Solution of Caoutchouc in repeatedly rectified Petroleum. *Ann. de Chim.* vol. xi. p. 195, xii. 156.

Pelletier, on Solution of Elastic Gum in Sulphuric Ether. *Mem. de l'Institut.* vol. i. p. 56; also *Repertory of Arts*, vol. xi. p. 285.

1801. Howison, on the Elastic Gum Vine of Prince of Wales's Island, and of Experiments on its Milky Juice, and Purposes to which it may be applied. *Asiatic Researches*, vol. v. p. 157.

Roxburg, Dr. Botanical Description of Urceola Elastica, or Caoutchouc Vine of Sumatra and Pulo-penang, and Comparison of its inspissated Juice with American Caoutchouc. *Asiatic Researches*, vol. v. p. 167.

1803. Gough, on a Property of Caoutchouc, &c. *Manchester Memoirs*, N. S. vol. i. p. 288; also *Repertory of Arts*, Sec. Ser. vol. viii. p. 105; and *Nicholson's Phil. Jour.* vol. xii. p. 305.

1805. Simple Method of making Tubes of Caoutchouc without Ether. *Phil. Mag.* vol. xxii. p. 340.

1807. Murray's Chemistry, vol. iv. p. 177, contains a compendium of what was then known respecting this substance.

The liquid caoutchouc or sap for Mr. Faraday's experiments was supplied by Mr. Hancock, (the proprietor of the preceding patent, and of one for a similar purpose, inserted in our last Number); who exhibited a variety of useful articles, made by the union of the liquid caoutchouc and various fibrous and woven substances, at the Lecture Room of the Royal Institution, when the liquid sap was first sent there by him; among which articles the specimens of muslin and silk, for cloaks, &c. rendered waterproof by this substance, excited peculiar attention.

The most singular circumstance respecting the caoutchouc sap furnished by Mr. Hancock is, its being brought over to this part of the world, for the first time, in a perfect state, which appears to have escaped the notice of Mr. Faraday, and its importance to be unknown to the proprietor. That which Mr. Fourcroy obtained in 1790 was coagulated in the bottle, and the whitish liquor surrounding the coagulum was insupportably fetid. That which Sir Joseph Banks received, about the same time, was in a similar state, and M. Grossart mentions that Sir Joseph was not able to procure a second supply, though he offered fifty guineas for another bottle of the liquid.

It would be very useful to discover to what circumstance the perfection of that received by Mr. Hancock was owing, which at present appears not to be known to himself. Mr. Faraday received it in a common bottle, in which nothing more was remarked but the formation of a slight film of solid caoutchouc on the surface of the cork which closed the bottle. It is, however, not improbable, that the perfection of Mr. Hancock's liquid caoutchouc may be caused by its being deposed in the hold of the vessel which brought it over, where it could remain much more cool than in the cabin; and where it was likely to be stowed, from its being sent in a considerable quantity, so as to form a bulky package; while the *single* bottles received by M. Fourcroy and Sir Joseph Banks were most likely kept in the cabins, to prevent them from being lost or broken.

We are inclined to think that the caoutchouc is produced by different trees and plants. M. Fourcroy states that it exudes from incisions made in the bark of the Hevœa. Mr. Howison describes it as being afforded by a vine or climbing plant, that ascends other trees like ivy; and Dr. Roxburg mentions that the urceola elastica yields the same substance, which being also a vine, may be the same as that found by Mr. Howison.

The countries where it is produced are for the most part inter-tropical; Fourcroy states it to be procured in Guiana, and that he had it also from the Isle of Bourbon, Cayenne, and the Brazils. Mr. Howison found it in the Prince of Wales's Island; Dr. Roxburg at Sumatra and Pulo-penang; and Mr. Hancock obtained it from the southern part of Mexico. The most northerly situations that we know, in which a plant that furnishes it grows, are the banks of the Red River, and of the Arkansas, near the Mississippi, which running between latitudes 35 and 32 N. give reason to suppose that the same plant might grow in the southern extremities of Europe: and that, as vast tracts may produce caoutchouc where there is a free population, we may receive it in abundance, uncontaminated by the tears and blood of our fellow creatures in slavery, which must be the case if the plant from whence it is procured be cultivated in the West Indies, as by some persons proposed, without due consideration.

Those who desire to dissolve the solid caoutchouc will find good instructions for doing so, by ether, in the publications of M. Grossart and M. Pelletier; but if its solution in coal tar oil will dry perfectly, as we have heard, it will be preferable to those mentioned, from its greater cheapness and facility of composition.

Account of Methods proposed in 1809 *by* MR. W. MURDOCH, *of Paisley, for making a Tunnel beneath the Thames.*

Abstracted from the Papers and Documents of the "THAMES ARCHWAY COMPANY."

THREE methods were proposed by Mr. Murdoch for this purpose, each of which had two modifications with respect to the materials of which the tunnel should be constructed, according as these were to be of masonry, or of cast and wrought iron.

The first of these, which deserves notice for its singularity, consisted in making two tunnels, one over the other; and only separated by arch work. These were each to be about 14 feet wide, including a narrow footway, and of the same height, arched at top with a semicircular arch, while the bottom was to be of an elliptical form in the brick tunnel, and flat in that of iron. The sides were to be straight, without any curvature, and the separation in the brick tunnel was to be a brick arch, of the same thickness as the walls, which was to be 27 inches; and in the iron tunnel, to be an iron floor, supported at every 8½ feet by an arched plate of cast iron, placed vertically, and dove-tailed at its ends, which ends were to be let down into dove-tailed sockets, cast for them on the plates, which formed the sides; and which plates were to be made with flanches, and bolted together with ¾-inch bolts, with the joints closed by running melted lead between them, and afterwards caulking them.

The roads in each tunnel were only to be filled up barely to a level over the arches, or other supports, that as little room as possible might be lost. Mr. Murdoch has added here a plan for separating the upper and lower passages in the iron tunnel by a *brick* arch, supported by projecting pieces, like bracketed shelves, cast on the side plates. In cases where the leakage was principally from the top, this mode of arranging the two tunnels might be found worthy of consideration, though not so economical as the next method proposed by Mr. M.

In the second method the two tunnels were to run on one level, beside each other, and close together. To save materials, the roof was to be supported in the line between them by arches, leaving passages sideways from one to the other. In the cast iron tunnel these arches were to be very flat, and to be sustained by pillars, 9 feet asunder; but in that of brick, the arches were to spring from the floor, which in this, as in the former method, was laid upon a reversed arch in each tunnel, formed in the same manner, as were also the arches at top which composed the roof. The tops of the cast iron tunnels were also to be arched, but their bottoms were to be flat. The roads and footways, and the dimensions of each tunnel or passage, were to be the same as in those first described.

The third method is somewhat similar to the second; but instead of the tunnel being double all the way throughout, it was only to be so at intervals of 200 or 300 yards, and that for a space of about 60 feet; and at the ends of these side passages it was intended to place bells, to give warning when the carriages were passing from them, to prevent accidents. This tunnel was to be either of brick or iron, as the others, to be formed in the same manner, and of the same dimensions as they were. In the drawings the side passages of the brick tunnel are represented as being separated from the main tunnel by solid walls; but a note states, that this part may be formed more economically by arches, as in the second method. The drawings also represent those passages as being alternately at different sides, which it is supposed induced Mr. Murdoch to name this method a "Winding Arched Tunnel;" but a note states here also, that those passages may be made all at one side, which would cause it to have little or no correspondence with the above appellation.

In all the methods proposed, the road is directed to rise 1 foot in 30 from the middle of the tunnel; but the drawings represent it as quite flat while beneath the river, and having a rise only at each side when it has passed its limits. The tunnel is also shown in them as being quite open above, after having passed the river a few feet, or more exactly, as terminating in that part in an open road, secured at the sides by walls of a proper shape and thickness to keep up the earth.

The iron tunnel in the first method is estimated at 72*l.* the running yard; that in the second at 50*l.*; and that in the third at 30*l.* for materials alone, where it was single, and at 50*l.* where double. The brick tunnel in the first method is rated at 32*l.* the yard; that in the second at 32*l.* also; and that in the third method at 20*l.* for the single part, and 42*l.* where it was double, exclusive of the expense of sinking, puddling, and draining, it having been intended to puddle outside the brick-work with clay, between 2 and 3 feet in thickness. The draining was to be performed by a "suction pipe," extending from the centre of the bottom of the tunnel to a steam-engine at its entrance.

Further Researches on the Preservation of Metals by Electro-chemical Means.

By Sir Humphry Davy, Bart. Pres. R. S.

(*From the Philosophical Transactions of the Royal Society of London.*)

In two papers read before the Royal Society[*] I have described the effects of small quantities of electro-positive metals in preventing the corrosion or chemical changes of copper exposed to sea water, and I have stated that the results appear to be of the same kind, whether the experiments are made upon a minute scale and in confined portions of water, or on large masses and in the ocean.

The first and preliminary experiments proved that the copper sheeting of ships might be preserved by this method; but another and a no less important circumstance was to be attended to,—how far the cleanness of the bottom, or its freedom from the adhesion of weeds or shell fish, would be influenced by this preservation.

The use of the copper sheathing on the bottom of ships is twofold. First, to protect the wood from destruction by worms: and secondly, to prevent the adhesion of weeds, barnacles, and other shell fish. No worms can penetrate the wood as long as the surface of the copper remains perfect; but when copper has been applied to the bottom of a ship for a certain time, a green coating or rust, consisting of oxide, submuriate and carbonate of copper, and carbonate of magnesia, forms upon it, to which weeds and shell fish adhere.

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[*] See Repertory, vol. XLV. p. 222, and vol. XLVI. p. 350.

As long as the whole surface of the copper changes or corrodes, no such adhesions can occur; but when this green rust has partially formed, the copper below is protected by it, and there is an unequal action produced, the electrical effect of the oxide, submuriate, and carbonate of copper formed, being to produce a more rapid corrosion of the parts still exposed to sea water; so that the sheets are often found perforated with holes in one part after being used five or six years, and comparatively sound in other parts.

There is nothing in the poisonous nature of the metal which prevents these adhesions. It is the *solution* by which they are *prevented—the wear* of surface. Weeds and shell fish readily adhere to the poisonous salts of lead which form upon the lead protecting the fore part of the keel; and to the copper, in any chemical combination in which it is insoluble.

In general, in ships in the navy the first effect of the adhesion of weeds is perceived upon the heads of the mixed metal nails, which consist of copper alloyed by a small quantity of tin. The oxides of tin and copper which form upon the head of the nail and in the space round it, defend the metal from the action of sea water; and being negative with respect to it, a stronger corroding effect is produced in its immediate vicinity, so that the copper is often worn into deep and irregular cavities in these parts.

When copper is unequally worn, likewise in harbours or seas where the water is loaded with mud or mechanical deposits, this mud or these deposits rest in the rough parts or depressions in the copper, and in the parts where the different sheets join, and afford a soil or bed in which sea weeds can fix their roots, and to which zoophytes and shell fish can adhere.

As far as my experiments have gone, small quantities of other metals, such as iron, tin, zinc, or arsenic, in alloy in copper, have appeared to promote the formation of an insoluble compound on the surface; and consequently there is much reason to believe must be favourable to the adhesion of weeds and insects.

I have referred in my last paper to the circumstance of the carbonate of lime and magnesia forming upon sheets of copper, protected by a quantity of iron above $\frac{1}{150}$ part, when these sheets were in harbour and at rest.

The various experiments that I have caused to be made at Portsmouth show all the circumstances of this kind of action; and I have likewise elucidated them by experiments made on a smaller scale, and in limited quantities of water. It appears from these experiments that sheets of copper, at rest in sea water, always increase in weight from the deposition of the alkaline and earthy substances, when defended by a quantity of cast iron under $\frac{1}{150}$ of their surface; and if in a limited or confined quantity of water, when the proportion of the defending metal is under $\frac{1}{4000}$. With quantities below these respectively proportional for the sea, and limited quantities of water, the copper corrodes; at first it slightly increases in weight, and then slowly loses weight. Thus a sheet of copper 4 feet long, 14 inches wide, and weighing 9lbs. 6 oz., protected by $\frac{1}{100}$ of its surface of cast iron, gained in ten weeks and five days 12 drachms, and was coated over with carbonate of lime and magnesia: a sheet of copper of the same size, protected by $\frac{1}{150}$, gained only 1 drachm in the same time, and a part of it was green from the adhering salts of copper; whilst an unprotected sheet of the same class, both as to size and weight, and exposed for the same time, and as nearly as possible under the same circumstances, had lost 14 drachms: but experiments of this kind, though they agree when carried on under precisely similar circumstances, must of necessity be very irregular in their results, when made in different seas and situations, being influenced by the degree of saltness, and the nature of the impregnations of the water, the strength of tide and of the waves, the temperature, &c.

In examining sheets which had been defended by small quantities of iron in proportions under $\frac{1}{250}$ and above $\frac{1}{1000}$, whether they were exposed alone, or on the sides of boats, there seemed to me no adhesions of confervæ, except in cases where the oxide of iron covered the copper immediately round the protectors; and even in these instances such adhesions were extremely trifling, and might be considered rather as the vegetations caught by the rough surface of the oxide of iron, than as actually growing upon it.

Till the month of July 1824 all the experiments had been tried in harbour, and in comparatively still water; and though it could hardly be doubted that the same principles would prevail in cases where ships were in motion, and on the ocean, yet still it was desirable to determine this by direct experiment; and I took the opportunity of an expedition intended to ascertain some points of longitude in the North Seas, and which afforded me the use of a steam-boat, to make these researches. Sheets of copper, carefully weighed, and with different quantities of protecting metal, and some unprotected, were exposed upon canvass so as to be electrically insulated upon the bow of the steam-boat; and were weighed and examined at different periods, after being exposed in the North Seas to the action of the water during the most rapid motion of the vessel. Very rough weather interfered with some of these experiments, and many of the sheets were lost, and the protectors of others were washed away; but the general results were as satisfactory as if the whole series of the arrangements had been complete. It was found that undefended sheets of copper of a foot square lost about 6·55 grains in passing at a rate averaging that of eight miles an hour in twelve hours; but a sheet having the same surface, defended by rather less than $\frac{1}{500}$, lost 5·5 grains;

and that like sheets defended by $\frac{1}{70}$ and $\frac{1}{100}$ of malleable iron were similarly worn, and underwent nearly the same loss, that of two grains, in passing through the same space of water. These experiments (the results of which were confirmed by those of others made during the whole of a voyage to and from Heligoland, but in which during the return the protectors were lost) show that motion does not affect the nature of the limits and quantity of the protecting metal; and likewise prove that, independently of the chemical, there is a mechanical wear of the copper in sailing, and which on the most exposed part of the ship, and in the most rapid course, bears a relation to it of nearly 2 to 4·55.

I used the very delicate balance belonging to the Royal Society in these experiments; the sheets of copper weighed between 7 and 8000 grains; and I was fully enabled to ascertain by means of this balance a diminution of weight upon so large a quantity equal to $\frac{1}{100}$ of a grain. It was evident from a very minute inspection of the sheet with the largest quantity of protecting metal, that there was not any adhesion of alkaline or earthy substances to its surface.

Having observed, in examining the results of some of the experiments on the effects of single masses of protecting metal on the sheeting of ships, that there was in some cases in which sheets with old fastening had been used, tarnish or corrosion, which seemed to increase with the distance from the protecting metal, it became necessary to investigate this circumstance, and to ascertain the extent of the diminution of electrical action in instances of imperfect or irregular conducting surfaces.

With single sheets or wires of copper, and in small confined quantities of sea water, there seemed to be no indications of diminution of conducting power, or of the preservative effects of zinc or iron, however divided or diffused the surface of the copper, provided there was a perfect metallic connexion through the mass. Thus a small piece of copper, containing about 32 square inches, was perfectly protected by a quantity of zinc which was less than $\frac{1}{4000}$ part of the whole surface; and a copper wire of several feet in length was prevented from tarnishing by a piece of zinc wire which was less than $\frac{1}{1400}$ part of its length. In these cases the protecting metal corroded with great rapidity, and in a few hours was entirely destroyed; but when applied in the form of wire and covered, except at its transverse surface, with cement, its protecting influence upon the same minute scale was exhibited for many days. A part of these results depend upon the absorption of the oxygen dissolved in the water when its quantity is limited, by the oxidable metal, and of course the proportion of this metal must be much larger when the water is constantly changing; but the experiments seem to show that any diminution of protecting effect at a distance does not depend upon the nature of the metallic, but of the imperfect or fluid conductor.

This indeed is shown by many other results.

A piece of zinc and a piece of copper in the same vessel of sea water, but not in contact, were connected by different lengths of fine silver wire of different thickness. It was found that whatever lengths of wire of $\frac{1}{300}$ of an inch were used, there was no diminution of the protecting effect of the zinc; and the experiment was carried so far as to employ the whole of a quantity of extremely fine wire, amounting to upwards of forty feet in length, and of a diameter equal only to $\frac{100}{98742}$ of an inch, when the results were precisely the same as if the zinc and copper had been in immediate contact.

Pieces of charcoal, which is the worst amongst the more perfect conductors, were connected by being tied together, and made the medium of communication between zinc and copper, upon the same principles, and with the same views as those just described, and with precisely the same consequences.

In my first experiments upon the effects of increasing the length or diminishing the mass of the imperfect or fluid conducting surface in interfering with the preserving effects of metals, I used long narrow tubes; but I found them very inconvenient; and I had recourse to the more simple method of employing cotton or tow for this purpose.

Several feet of copper wire, in a spiral form, were connected with a small piece of zinc wire of about half an inch in length. The zinc and a portion of the copper were introduced into one glass, and the coils of copper wire were introduced into other glasses, so as to form a series of six or seven glasses, which were filled with sea water, and made part of the same voltaic arrangement, by being connected with pieces of tow moistened in sea water.

It was found in these experiments, that when the pieces of tow connecting the glasses were half an inch in thickness, the preserving effect of the zinc in the first glass was no where diminished, but extended apparently equally through the whole series.

When the pieces of tow were about the fifth of an inch in thickness, a diminution of the preserving effects of the zinc was perceived in the fourth glass, in which there was a slight solution of copper; in the fifth glass this result was still more distinct, and so on till in the seventh glass there was a considerable corrosion of the copper.

When the tow was only the tenth of an inch in thickness, the preserving effect of the zinc extended only to the third glass; and in each glass more remote, the effect of corrosion was more distinct, till in the seventh glass it was nearly the same as if there had been no protecting metal. All the chemical changes dependent upon negative electricity were successively and elegantly exhibited in this experiment. In the first glass, containing the zinc, there was a considerable and hasty deposition of earthy and alkaline matter, and crystals of carbonate of soda adhered to the copper at the surface where it was clean and bright; but in the lower part it was coated with revived metallic zinc. In the second glass the wire was covered over with fine crystals of carbonate of lime; and the same phenomenon of the separation of carbonate of soda occurred, but in a less degree. In the third glass the wire was clean, but without depositions; and the presence of alkaline matter could only be distinguished by chemical tests. In the fourth glass the copper was bright, evidently in consequence of a slight but general corrosion, but with a scarcely sensible deposit. In the fifth the deposit was very visible; and in the seventh the wire was covered with green rust.

These results, which showed that a very small quantity only of the imperfect or fluid conductor was sufficient to transmit the electrical power, or to complete the chain, induced me to try if copper nailed upon wood, and protected merely by zinc or iron on the under surface, or that next the wood, would not be defended from corrosion. For this purpose I covered a piece of wood with small sheets of copper, a nail of zinc of about the $\frac{1}{100}$ part of the surface of the copper being previously driven into the wood: the apparatus was plunged in a large jar of sea water. It remained perfectly bright for many weeks; and when examined, it was found that the zinc had only suffered partial corrosion, that the wood was moist, and that on the interior of the copper there was a considerable portion of revived zinc, so that the negative electricity, by its operation, provided materials for its future and constant excitement. In several trials of the same kind, iron was used with the same results; and in all these experiments there appeared to be this peculiarity in the appearance of the copper, that unless the protecting metal below was in very large mass, there were no depositions of calcareous or magnesian earths upon the metal; it was clean and bright, but never coated. The copper in these experiments was nailed sometimes upon paper, sometimes upon the mere wood, and sometimes upon linen; and the communication was partially interrupted between the external surface and the internal surface by cement; but even one side or junction of a sheet seemed to allow sufficient communication between the moisture on the under surface and the sea water without, to produce the electrical effect of preservation.

To be concluded in the Supplement.

Description of Cast-iron Trusses or Cradles, for sustaining decayed or sunken timbers.

By MR. ALFRED AINGER, *Everett-street, Russell-square.*

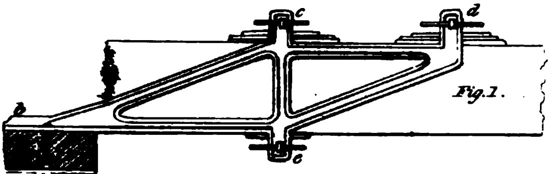
From the Transactions of the Society of Arts, &c. Vol. XLII.

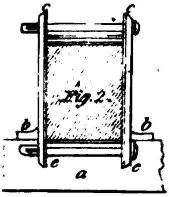
The large Gold Medal was presented by the Society to Mr. Ainger for this invention.

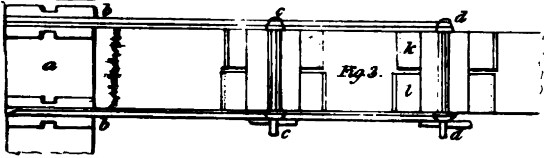
WITH AN ENGRAVING.

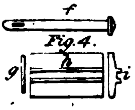
I HEREWITH offer to the Society models and drawings of various cast-iron trusses or cradles, designed for the purpose of supporting girders, tie-beams, or other timbers, whose ends have become decayed; and also for raising and sustaining bearers of any sort which have sunk in the middle. Before describing any of these particularly, I will detail the circumstances which led to their invention, and to the successful application of one of them in a case of considerable difficulty.

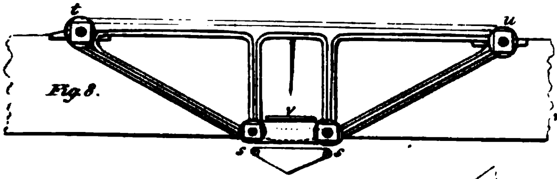
During the repairs performed in the past year to the church of St. Mary Aldermary, in the city of London, one of those erected by Sir Christopher Wren, it was discovered that nearly all the timbers of the roofs or flats over the aisles had become infected with the dry rot, some of them so much decayed by it as to have lost all bearing on the walls, and to have suffered a partial decomposition through their whole length. Their removal would have involved the destruction of a highly enriched, groined, and











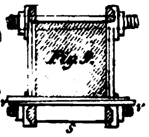
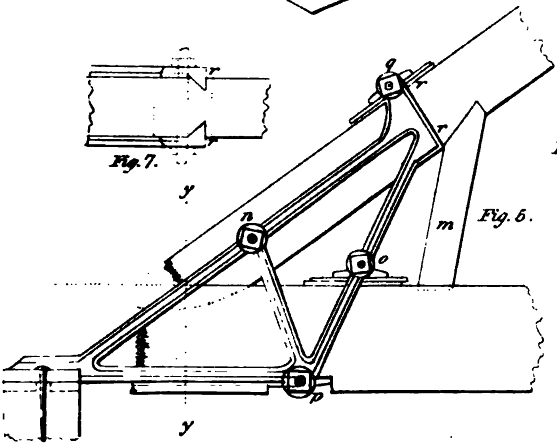
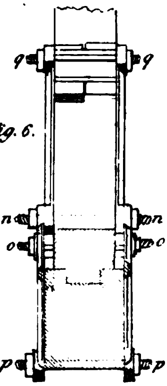
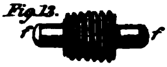
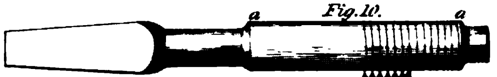
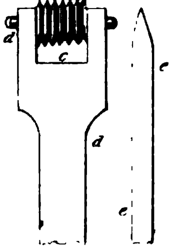


Fig. 7.







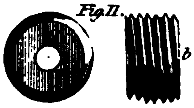


Fig. 12.

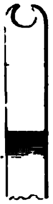


Fig. 16.

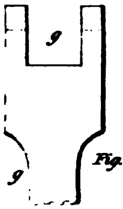
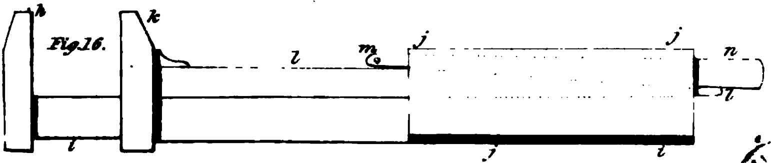


Fig. 14.



pannelled ceiling, whose restoration would have cost probably five thousand pounds, and the ribs and cradling of which (themselves in some parts almost perished) were immediately suspended from the decayed and decaying beams.

To secure these beams, therefore, not merely without removal, but with as little cutting and violence as possible, became an object of considerable importance. To have bolted pieces of timber to their sides, as is commonly practised, would have been altogether useless, for, by that plan, the weight is made to rest on a bearing equal only to the size of the bolts, which would have cut through or crushed the fibreless and disintegrated matter to which the ends of the beams had become reduced. Independently of which, it is evident that the support afforded by one piece of timber bolted to the side of another depends on the resistance offered by each of them to opening or splitting in a line with one or more of the bolts which pierce them, and that they have to oppose the mere cohesion of their fibres to the operation of a powerful leverage; that cohesion is in the first instance uncertain and inadequate, and it becomes every day more so by the progress of the disease in the old timber, and by its inevitable communication to the new.

The use of wood, therefore, was rejected, and the application of iron determined on. The number of beams in the condition described was fifteen, making of course thirty ends which required securing. Economy dictated the use of cast-iron in a case where so many similar parts would be wanted, and it only remained to dispose the metal in such a form as should make the smallest possible quantity produce the required effect, and should at the same time afford the greatest facilities in fixing. The form described in the models and drawings seems obviously to answer these conditions: it was adopted, and the plan carried successfully into execution with a degree of rapidity and ease which was in some measure surprising even to myself, and without the slightest injury to the ceiling.*

That part of the roof which covered the nave, and which was composed of principal rafters and tie-beams, framed with king-posts in the usual manner, was comparatively sound, but, nevertheless, decayed to a greater or less extent at all the bearings on the walls. In the former case it was required merely to support the ends of a simple bearer or girder, pressing perpendicularly by its own weight and that of its load; a task much easier than that of receiving the weight of the horizontal beam with its load, and at the same time opposing the lateral thrust of the rafter loaded with two or three tons of timber and lead, increased to four or six tons by reason of its inclined direction. I send a model of a design which I made for this purpose, but which, from various causes, was never executed. Among these causes, however, must not be placed any doubt of its success or of its economy, because, from the experiments made with the model, it appears to be perfectly easy in its application and effectual in accomplishing its object.†

Together with these I send a model of a plan for quickly and cheaply raising and sustaining swagged or sunken girders, with the least possible disturbance of the floor, and without any injury to the ceiling below it.‡

REFERENCE TO THE ENGRAVINGS. (Pl. XIII.)

Fig. 1 is a side, fig. 2 an end, and fig. 3 a top or bird's-eye view of the truss first alluded to, exactly as it was applied. In each figure *a* is the wall plate, the beam being shown wholly unsupported by it, as was the case with several of those to which the trusses were fixed. The trusses or cradles consist of two equal and similar cast-iron side pieces; each composed of two triangles, *b c d e*, spreading at the feet *b*, to rest on the wall plate, and each having three ears, *c c'*, *d d'*, and *e e'*, pierced to receive the wrought-iron bolts which unite each pair together. The bolts, of which one is shown separately at *f*, fig. 4, were made with a head at one end and a slit at the other, to receive a key (see *g*, fig. 4). Between the bolts and the timber were introduced cast-iron plates, their length equal to the width of the timber, and their breadth six inches: one of these is described at *h* and *i*, fig. 4, showing the groove which received the edge of the bolt *f*. The operation of fixing was as follows:—A temporary support was given to the beam; so much of the rotten timber as seemed advisable was cut away: the wall plate, which had decayed, was exchanged for a new one; and one man being placed on each side of the beam, the two halves of the truss were at the same moment rested on the wall plate, and supported at the other extremities by one hand of each man, while, with the hand at liberty, one man passed the bolt through the ear, *d'*; and it was guided through that at *d* by the remaining unemployed hand, which also introduced the key. The weight of the trusses being thus supported, they were left suspended by the bolt at *d d'*, while one man took one of the grooved plates, *h*, fig. 4, and held it against the underside of the beam at *e*, till the bolt could be passed through by the other. This bolt being also keyed, the ends, *d d'*, were lifted till the plate at *e* pressed against the beam (from which it would be distant in the first instance about half an inch); a grooved plate was then put under the bolt at *d*, the keys were slightly tightened to give connexion to the whole, and two pairs of oak wedges, *k k* and *l l*, were driven under the plate at *d*, by which of course the bolt and plate at *e* were made to *bite* against the beam, and the feet of the trusses were thrown with great force upon the wall plate. By using two pairs of wedges each foot was made to take a bearing independently of any irregularities in the wall plate or in the shape of the beam. A similar bolt, plate, and wedges, were applied at *c*, but these were merely to give stability and connexion to the several parts, as they evidently support no part of the weight. The feet of the trusses had notches on their edges, in which spikes were driven to restore the usual connexion between the timber and the wall. The whole operation of fixing (excluding of course the time employed in supporting the beam, exchanging the wall plate, and so on), occupied, as may be imagined, not more than 10 or 15 minutes, nor did it occasion the slightest disturbance either to the ribs or plastering of the appended groining and pannels.

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* The details of the mode of fixing, expences, and other particulars, are given in the description of the engravings.

† This also will be found more particularly described in the references to the engravings.

‡ A description of this is added to that of the other engravings.

The principle upon which this truss is constructed is evidently that of converting a transverse strain upon a certain quantity of metal into two other strains, each acting upon half the quantity, nearly in the direction of the length, one having a tendency to crush or bend, and the other to rend the metal: the two upper limbs, *b c* and *c d*, are in this case exposed to the former, and the two lower ones, *b e* and *e d*, to the latter. To make the truss, therefore, theoretically perfect, it would require that the strength of the upper and lower limbs should have an accurate relation to the different offices they perform. The liability to compression is small compared with that to extension, but the latter may, in some cases, be less than the liability to bend; this last, in fact, is so uncertain as to defy any very nice applications of theoretical strength, while the tension, and consequently the required size, of the lower limbs may be ascertained with great precision. The tension on the limb, *b e*, for instance, and on the similar limb on the other side of the timber, may, with sufficient accuracy for all practical purposes, be resolved into a case of the bent lever, in which *b e* may be considered one arm, *e c* the other, and *b* the point at which the power is applied, (the power being half the weight of the beam and its load, when the load is equally distributed). If, therefore, 10 represent the arm *ce*, and 25 the arm *be*, which were about the actual lengths in inches, measuring from the intersections of the centres of the limbs; if, also, W express the whole weight of the beam and its load, then putting $\frac{W}{2}$ for the power, the direct strain on the two limbs is $\frac{25}{10} \times \frac{W}{2} = 1{\cdot}25$ W, or one and a quarter times the whole load. The tension then, on each, is ,625 W; and if F measure the cohesive force of a square inch of the material in the same terms (pounds for instance) as those in which W indicates the weight of the load, the required area of section for each of the lower limbs will be expressed in inches by $\frac{,625\ W}{F}$.

The calculated size for the lower limbs will generally be found sufficient for the upper ones; and as the metal cools better in uniform bars than in others, it will seldom be advisable to make any difference.

In this particular case the section of each limb was a parallelogram, two inches by one inch, having the two external angles truncated or reduced till it approached to a triangle, and till the area was 1.6 inches. In an experiment made for the purpose of assuring the safety of the trusses, they were applied to a new piece of timber, twelve inches by ten inches, their feet resting on bearers twenty-one feet asunder. The beam was about twenty feet long, consequently clear of the bearers at each end, and it was loaded gradually with somewhat more than six tons. It was by that time considerably bent, and as the load was much larger than that which the actual beams could ever have to sustain, it was useless to pursue the experiment further. The ends remained perfectly unaltered, and thus assured the efficacy of the trusses to the amount of six tons.

To be concluded in the Supplement.

Of Lime which hardens in Water. By M. Hassenfratz.

(Continued from p. 316.)

The stone proper for making *plaster cement* is found on the coast of Boulogne; it is in masses of those rounded stones which are seen every where on the borders of the sea, which are commonly called pebbles. Those which are used have, like all the other rounded pebbles, a very irregular form, more or less oblong, and sometimes flat; they are never very large.

The most common colour of the external surface of the stone approaches that of rust.

It is cold to the touch; its specific gravity is 2·160, and it is very hard and difficult to break.

The form of its fracture is very variable, commonly smooth and flat, or conchoide, and sometimes uneven and striated; its fragments are irregularly shaped, with acute angles; the shade of its fracture is of a grey body, with a rust colour at its borders; its grain is very fine and very compact, and of a pasty appearance; the surface of the fracture is a little greasy to the touch.

Viewed with a magnifying glass, it exhibits some brilliant points, which good eyes can perceive without its assistance. It adheres slightly to the tongue; the point of a knife makes traces on it of a greyish white; the stone does not strike fire with steel; it produces an effervescence very quickly with nitric acid; there remains on the edge of the stone a tint of rust well defined.

The calcination of this stone is similar to that of common lime-stone; if it is too much heated it becomes vitrified, and is no longer fit for making cement. When it is well roasted, its exterior colour is yellowish, sometimes mixed with long yellow and reddish streaks. The stone is smooth to the touch, and, without being greasy, it leaves on the finger an extremely fine dust; its fracture is of a greenish yellow; the roasted stone is still very hard, although it comes out of the furnace all cracked; its density is 1·332. The roasted stone may be preserved for many years without alteration, provided that it is kept from humidity; it has such an attraction for water that it adheres strongly to the tongue, without having the causticity of lime.

To know and distinguish these stones without being obliged to analyze them, it is necessary to break them into lumps of the size of a walnut, to expose them to a common fire until they are red hot, and to leave them in this heat for six hours. On taking them from the fire they should be light, of a pale or brownish hue outside, and brown within; they never fuse; when they become cold they are reduced to powder; this powder is mixed with water, and by working it a thick paste is formed. If this paste grows hard in ten minutes or a quarter of an hour, and does not soften when put into water, it is a true natural cement.

Every thing leads to the belief that this stone is more common than is supposed. Much lime is found, as that of Padua and Montelimart, whose properties sensibly come near those of plaster cement, but which have them not in such a high degree; it is, in some respect, in an intermediate state between lime proper for constructions in water and natural cement. In many places where lime is made, stones are found which slack with difficulty after calcination. The lime-burners carefully reject them; nevertheless, many of these calcined stones, reduced to powder, furnish a lime which produces a cement more hard and more solid than the stones which slack more readily. Among these stones some are often met which have all the properties of the natural cement of Boulogne; some of these properties are natural to the stones, and others are the result of over calcination.

The calcareous stones with which the Roman cement is made at London, are calcined in conical kilns, with a continued fire of fossil coal; but the management of the fire requires much attention, because, when the heat is not properly regulated, the cement experiences a commencement of fusion, and is no longer good for any use. When it is roasted it is reduced to an impalpable powder under mill-stones, and is sent off packed up in barrels. It is worth, in London, about 100 francs the cubic metre.

It is easy to conclude, from all that has been said of *limes which harden in water*, and are proper for making natural *betons*, that they are composed of lime, silex, alumen, magnesia, and oxide of iron; that silex, alumen, or oxide of iron, singly, do not give to lime the property of hardening in water; that magnesia by itself can give it that property; that alumen should necessarily be combined with silex, and form a silicate of alumen, in order to make hardening limes; that the oxide of iron ought to be united to clay; that the magnesia, combined with silex and even with clay, augments the hardening quality; and finally, that the hardening properties vary with the proportions of the substances combined with the lime.

Every lime which contains earths mixed or combined with it is a meagre lime; that is to say, which does not swell as much, or produce as much slacked lime, as the carbonates of pure lime. All the limes which solidify by themselves are necessarily meagre limes; but all meagre limes are not hardening limes. The property of hardening, and particularly of hardening in water, depends on a certain proportion of the siliceous substances, the alumen, the magnesia, and the oxide of iron, combined with the lime. Thus meagre limes may contain such proportions of these substances that only one part of them shall contribute to the induration. This portion, whatever it may be, we name the *alyodra*, (derived from the Greek words *αλυω*, insoluble, and *δϱαω*, to make). The following is the method indicated by M. Raucourt, of Charleville, for determining the proportion of the *alyodra* in a meagre lime, which occasions it to harden.

First find the value of the whole quantity of foreign matters, which constitute the meagre lime, and then the quantity of those matters, or of the *alyodra*, which gives it the hardening property. The difference between those two quantities will show that which only tends to make the lime meagre, without giving it the property which is desired.

The proportion of foreign matter may be found by chemical analysis, or by the quantity of water necessary for slacking the lime. We will now relate the method used by Smeaton for determining this proportion.

The stone is to be pounded fine, and passed through a silk sieve; any weight of this dust is to be put into a capsule, and on it is to be poured, by degrees, muriatic acid, diluted with a small quantity of water, stirring it continually with a glass tube or a small wooden rod. When the effervescence ceases, no more acid is to be added; the solution is then to be evaporated by a gentle heat, until the whole becomes of a pasty consistence; the matter is then to be diluted with a proper quantity of water and filtered; the argil remains on the filtre. This substance is then to be dried by the sun, or before the fire, and then to be weighed; or, what is still better, it is to be calcined to redness in a crucible, before being weighed.

Smeaton, in thus terminating his analysis, did not know whether magnesia existed in the stone or not; many of them, however, contain it, even in very considerable quantities. To shew the magnesia, and determine the quantity of it which the stone contains, very clear water is to be poured into the solution as long as it yields a precipitate. This precipitate, which is magnesia, is to be collected on a filter as speedily as may be; it is to be washed with pure water, to be calcined, dried as much as possible, and finally weighed.

As the means of analyzing lime are not always convenient, the quantity of the combined substances may be known, by approximation, from that of the water necessary for slacking the lime to the consistence of pap; pure lime requires of it as much as four times the weight of the lime; very meagre lime a portion equal to itself; which lime is supposed to contain the same quantity of foreign matter and of lime, from whence may be perceived that the quantity of water employed in slacking is not proportional to the pure lime contained in the meagre lime.

To find the value of the proportion of the hardening part, or the *alyodra*, the lime should be mixed with water so as to support the pressure of the finger, and then be exposed to the action of water until it sets; that is to say, until it can support, without depression, a sharp stake charged with a light weight. It is to be remarked that limes which are eminent for hardening, and which set the first day, contain about one half of the hardening matter, and that those which do not set before the fifteenth day contain only a fourth of the hardening base, or *alyodra*. Thus, let us suppose with M. Raucourt, meagre limes which require but one part of water to moisten them, and which consequently contain equal parts of the lime, and of the foreign matters. If these limes set in 24 hours they will be eminently hardening, and will contain equal parts of the hardening base; that is to say, of the *alyodra* and of the lime; consequently all the foreign matter will be *alyodra*. If the lime does not set until the eighth day, it will only contain two parts of the hardening base, or *alyodra*, to three parts of the lime; and it will then have one part of foreign matter, which is useless, to five parts of hardening lime. Finally, if the lime does not set before the end of fifteen days, it will have one part of the hardening base, or *alyodra*, to three of the lime, and consequently two parts of the foreign base to four of the hardening lime, or one part in two. M. Raucourt estimates the first lime half of the hardening base; the second two-fifths; and the third one quarter.

Physico-Chemical Researches on Charcoal.

By M. CHEUVREUSSE, Professor of Chemistry at the Royal School of Artillery and Engineering. *Annales de Chimie, Aout,* 1825.

MEN of science, both ancient and modern, have published a great number of works on the properties of charcoal, and notwithstanding the extent of their researches, the most of their labours are incomplete.

In considering charcoal with respect to electricity, they have remarked that some charcoals give a free passage to that fluid, while others refuse to transmit it; but they have not analyzed the circumstances of this phenomenon.

On the other hand, charcoals have been regarded in general as bad conductors of caloric; nevertheless, experience shows that there is a great difference between them in this respect.

If the labours undertaken on the hygrometric properties of charcoal are examined, it will be seen that they have not been pursued.

The combustibility of charcoal has been studied; but the results presented leave much to be desired.

The state of imperfection in which our knowledge of charcoal is found at present, has led me to submit the properties of this combustible body to a new examination.

I will make it be seen that charcoal may be found in two states relative to its faculty of conducting electricity; then I will endeavour to prove that the same takes place with regard to its power of conducting caloric, and that the same sort which conducts electricity likewise conducts caloric.

Finally, in treating of the combustibility, I will make it evident, that a charcoal from the same piece of wood will be found more or less combustible, according to its state of carbonization.

Of the Carbonization.

If two pieces of wood, produced by the same branch, be taken, and submitted to distillation in a retort of stone ware or porcelain, until no more vapours pass off, two pieces of charcoal will be produced of the same nature, and in the same state of carbonization.

If, after this first carbonization, one of the pieces of charcoal be replaced in the retort, and be heated to redness, from these two operations two pieces of charcoal will be obtained, which will possess very different properties.

All sorts of light and heavy wood which could be procured, both native and foreign, submitted to these two distillations, have given charcoals which presented the same differences.

Charcoals from animal substances, produced by a first distillation, could not be made to change their state but by a violent degree of fire.

To change the property of vegetable charcoal, it was sufficient to make the fire red; the method of applying the heat is indifferent. Whether the operation is performed in close vessels, or in the open air, the result is the same. If it is effected by ignition, the mode of extinction is equally indifferent.

In general, charcoal may be found in two opposite states, resulting from the intensity of the heat which has been applied to them during their preparation.

In the course of this memoir I will distinguish the two sorts of charcoal into charcoal in the first state, and charcoal in the second state of carbonization.

Of the Conductibility for Electricity.

It has been long since remarked, that among charcoals some had the property of transmitting the electric fluid, but the study of the circumstances which accompanied this faculty has been neglected.

In the experiments which I am going to recite, all the charcoals in their first state of carbonization, and which are newly prepared or dried, do not ever conduct electricity, and they do not become conductors but when they have undergone the action of a strong fire.

A fact which it is important to recite is, that the charcoal which is not a conductor does not develope electricity by its contact with zinc or iron, and when it is a conductor it produces electricity by this contact.

The conducting property of a charcoal for electricity may therefore be verified by the contact of zinc or of iron; and this simple method is even preferable to others, since, if the non-conducting charcoals are humid, they transmit electricity; wherefore the application of one of these two metals, and principally of zinc, will be the method which we will use to ascertain the state of conductibility of a charcoal for electricity.

If charcoal which is to be examined is in a state of powder, it may be made into a paste with gum water, and a tablet may be obtained which may be tried with facility. The only precaution to be taken is, not to add more of the mucilage than is necessary for making the paste.

To a charcoal in the first state of carbonization, the faculty of conducting the electric fluid at one of its points may be given, by making this point red hot. This experiment is easily performed by heating a small cylinder of charcoal at the flame of a candle; when it becomes red it is to be dipped in water. If it is then tried, it will be perceived to have become a conductor of electricity.

The best conducting charcoals which I have as yet been able to meet, are those which have escaped combustion during the reduction of iron ore in the high furnace, and which are drawn out along with the slag.

From these results we may range all these charcoals into two great classes,—charcoals that are conductors of electricity, and charcoals which are non-conductors.

Of the Conductibility for Caloric.

Nothing has yet been published on the conductibility of charcoal for caloric; and this combustible body having been known to present the greatest resistance to this fluid, has been named a *bad conductor*. This error has arisen from its having been believed that charcoal only existed in one state; but the experiments which follow prove that some charcoals refuse to conduct caloric, while others transmit it with sufficient facility; and it is extremely remarkable, that the charcoals which are conductors of electricity are also equally conductors of caloric.

If a piece of charcoal be chosen without cracks, and without knots, of a cylindrical form, about three lines in diameter, in the first state of carbonization, and that one of its extremities be exposed to the flame of a candle, the heated part will enter into combustion, and the propagation of the heat will not be sensibly extended beyond the part immersed in the flame.

If the same operation is repeated with a cylinder of charcoal, taken from the same wood, in the second state, and consequently a conductor of electricity, the effects which will be observed will be different: the caloric will be immediately transmitted from one end of it to the other, and the sensation of heat will become so great that fingers of any delicacy would be unable to hold the charcoal in the experiment. The extremity placed in the flame will moreover be observed to grow red, and not to burn in so decided a manner as in the first case.

The theory had before pointed out that the effects observed should thus take place: in the first experiment the accumulation of the caloric increased the ignition; and in the second its transmission opposed the inflammation.

These simple experiments may show the difference of conductibility between the two sorts of charcoal; but as they do not seem sufficient for naturalists accustomed to the most scrupulous exactness in all their researches, I have made use of the little apparatus which I am going to describe.

To make this experiment, a vessel of earthern ware, or of wood, may be used, the sides of which are of equal thickness. These sides should be pierced with two holes, from 0·015 metre to 0·020 in diameter, for the reception of two charcoals of the same dimensions, the length of which should be exactly equal, and which should only differ in their state of carbonization.

The external extremity of each of these charcoals should be hollowed, to receive the bulb of a thermometer, which should be kept in contact with it, and should be supported in an horizontal position. The vessel should then be filled with mercury, the temperature of which should be near ebullition.

The result of this disposition must be, that the two charcoals would be in the same circumstances, since their interior extremities are exposed to the same source of caloric.

In one of the experiments made with this apparatus, on employing two charcoals of poplar, one in the first state of carbonization, and the other in the second, and on using two thermometers marking 20° (Reaumur), before the operation, I observed that the thermometer, applied to the charcoal in the second state, rose rapidly from the instant that the vessel was filled with mercury, whilst the other was stationary, and that a few instants afterwards it indicated 38°, that of the charcoal in the first state of carbonization being still at 23°; that is to say, 15° below the first.

The thermometer, lodged on the charcoal in the second state of carbonization, arrived rapidly to its *maximum* of 40°, while the other, after a long interval of time, did not rise beyond 25°.

This last experiment leaves no doubt respecting the difference of conductibility of the two charcoals for caloric; and it proves besides, that the charcoals which are conductors of electricity are equally conductors of caloric.

We have, therefore, a sure method of knowing, *à priori*, if a charcoal is fit to be employed as a non-conducting body in a physical apparatus.

Of the Density.

It is known that the specific gravity of charcoals in general varies according to the density of the wood from which they are made; but in the course of my experiments I have always remarked, that those of equal weight in the first state of carbonization had constantly a greater bulk than those in the second state, that is to say, which had been prepared in the contrary circumstances.

To verify this first perception, I examined the density of charcoals of black alder in their two states. To effect this design, I weighed equal volumes of the charcoals, divided to the same thickness, and in the two states of carbonization already recited, and found that the density of the charcoal of black alder, in the first state of carbonization, is to that of the charcoal of the same wood in the second state, as 4 is to 3.

I then took charcoals of the extreme limits of density afforded by those in my possession, that is to say, poplar and guiacum; the woods of which had for their respective densities 0·3042 and 1·3132; but instead of weighing them after I had pulverized them, as in the first case, I took their weight in air and in water, in determining the quantity that they absorbed of the latter, and I then obtained the following results:—

Charcoal of Poplar,—	1st carbonization	0·12372
	2d carbonization	0·18743
Charcoal of Guiacum,—	1st carbonization...	0·68718
	2d carbonization...	0·84829

From this table the consequence may be drawn, that of light wood, that of poplar for example, the charcoal in the first state of carbonization has a density two-thirds of that of charcoal in the second state of carbonization; whilst for the more compact woods, such as that of guiacum, the density of the charcoal in the first state is a little above three-fourths of that of the charcoal in the second state.

These experiments prove, moreover, that charcoals prepared from the same wood may be, with regard to their density, distinguished into two classes, and that the most dense charcoals are those which are conductors of electricity and of caloric.

To be continued.

A Machine for collecting Clover Seed, improved by M. Mottin.

From Bibliothéque Physico-économique.

THIS machine is composed of a wooden box, 6 decimetres (= 2 feet nearly) long, 12 wide, and 6 deep. It is carried on two wheels, 21 centimetres (= 8.3 inches) in diameter. On the front is placed a horizontal comb, furnished with fifty iron teeth, each 24 centimetres long, 23 millimetres wide, and 5 millimetres apart at their centre, but approaching nearer together towards each end. Their points are slightly bent upwards, and appear underneath in form of a prism. They are screwed separately on a bar of iron, from which they can be removed easily, one after another, to repair them.

The feeblest animal is able to draw this machine. It is guided by a man, by means of two handles similar to those of a plough. These handles serve to rock it upon its axle, according to the height of the clover, the stalks of which are caught in the comb. The resistance of the iron teeth pulls off the heads of the clover, and they afterward fall into the box, which is emptied as soon as it has become full.

ACCOUNT OF NEW PATENTS.

Patent granted to **Mark Cosnahan,** *of the Isle of Man, Esq. for a new apparatus for ascertaining the lee-way of ships, and which is applicable to other purposes.* Dated March 17, 1825.

This apparatus, which the patentee calls a *computist,* consists of a narrow metallic case, a few inches in length, at the top of which is attached a graduated dial and index, while from its other end a square stem issues, graduated also at its side, and pressed upwards into the case by a spiral spring, which surrounds it within the case, and is fastened above to its upper extremity, while its other end is sustained by the bottom of the case.

One side of the square stem is graduated with divisions, three-eighths of an inch asunder, subdivided into halves and quarters, which are to represent the number of pounds and parts of pounds, that acting on the stem would draw it out to those notations. Another side of this stem, at right angles to the former, is marked with divisions, six-eighths of an inch apart, subdivided as the other, into halves and quarters, which divisions are intended to denote the *knots,* or miles, of the rate of a ship's way. On a third side of the stem, opposite to the first, notches are made, into which the point of a catch enters at little way, that is pressed against them by a spring at the side of the case, but which does not act with sufficient power to prevent the stem from being drawn up into the case by the spiral spring by which it is surrounded, when not drawn out by a superior force.

The hand of the dial before-mentioned is moved by a brass pulley, of sufficient size to admit of the girth of its circumference being equal to the length of the stem, and two brass pulleys being fixed at the top of the case inside, and two more at the bottom, a small endless chain passes round them all and the large pulley of the dial, which chain being fastened to a piece projecting from the top of the stem for that purpose, will draw the large pulley round according as this part ascends or descends, and will cause the hand of the dial to point at marks on it similarly numbered to those on the stem.

It appears from this description, that there are two indexes to this instrument; and the patentee states, that though that on the stem may be used without the dial, yet that he finds it more convenient to have the latter also.

At the bottom of the stem is a ring, from which a line goes to the *log-ship*, and the instrument being fixed on the taffarel, or at one side of the cabin window of a vessel, on throwing the log-ship overboard its resistance will cause the stem to be drawn out, more or less, in proportion to the velocity with which the vessel moves, which will be shown both by the hand of the dial, and the index of the stem.

The *log-ship*, of which a figure is given, is a semicircular piece of board, to which the line is joined by four cords of equal length, two of which are fastened to the ends of its diameters, where it is divided, and the two others to its circumference, at equal distances from the former and from each other. Another small cord being fastened to its upper part, and extended to the vessel, serves to draw it in when required; and a cork float, attached to the same part by a cord about eighteen inches in length, completes this implement.

To ascertain the lee-way of the vessel a *demi-compass dial* is used, with a hand proceeding from its centre, at the end of which is a ring, by which the apparatus described is attached to it with a cord; and this demi-dial being then fixed on the middle of taffarel, its hand, when the log-ship is in action, will point out the angle in which the way of a vessel varies from its direct course; the extent of which angle, in conjunction with the velocity of the motion ascertained by the same instrument, forms a basis by which the lee-way may be computed.

The application of the spring statera (or implement which determines weights by the tension of a spiral spring) to ascertain the rate of velocity with which a ship moves on its course, which is claimed by the patentee, is by no means a new invention, as any of our readers may satisfy himself, by perusing a paper on this subject in the eleventh volume of our Second Series, p. 22, by Mr. J. W. Boswell, who proposed the use of this instrument for the same purpose at that early period, and pointed out a method by which the velocity of the vessel might be computed from the increased pressure on the spring, denoted by the degrees on the scale; a circumstance which, though evidently very necessary, has been entirely omitted by the patentee.

The implement described in this specification differs, however, from that proposed in the paper above-mentioned, in having a dial in addition to the scale on the stem; but this addition the patentee himself states not to be essential.

The method of applying the *demi-compass dial* to determine the lee-way of the vessel by the angle of variation from the direct course, recited in the account of the specification, is also, as far as we know, the sole property of the patentee.

Patent granted to Joseph Bower, *of Hunslet, in the parish of Leeds, Yorkshire, Oil of Vitriol Manufacturer, and to* John Bland, *of the same place, Steam-engine Manufacturer, for their improvement in such steam-engines as condense out of the cylinder; by which improvement the air-pump is rendered unnecessary.* Dated July 31, 1823.

The apparatus for the purpose mentioned in the above title consists of a cylindrical condensing vessel, surrounded by another air-tight vessel of the same figure, but of a larger diameter, and of course leaving a space between it and the first. From the bottom of the first vessel a tube descends through the second, thirty-four feet, into a shallow cistern, and has there a valve on one side of its lower end, opening outwards; and into the top of the same vessel the tube, which carries off the steam from the working cylinder of the steam-engine, enters a few inches, leaving a small space between its circumference and the aperture by which it enters, for the passage of cold water, while it is joined air-tight to the external vessel. To produce the condensation necessary in the internal vessel, and in the lower tube, a constant stream of cold water, of a regulated extent, is to be made to pass through the space between the two vessels, and over the top of the internal one, by the narrow annular aperture between it and the steam-pipe, down into the lower tube, where, besides condensing the steam, which has entered into it and into the internal vessel, it is intended to act by an hydrostatic pressure superior to that of the atmosphere, in forcing out the water condensed from the steam, along with itself through the lower valve.

The patentee proposes to produce the supply of cold water for the purpose mentioned, from a cistern below the level of the condensing vessel, by a tube rising up from the former into the bottom of the space between the two vessels, which, forming with the long tube before-mentioned, the two legs of a siphon, will, by the well-known principle of that instrument, convey the water upwards over the top of the internal vessel as required.

The tube of supply rises from near the bottom of the upper cistern, and from it at that part a pipe, furnished with a cock, passes across to the long descending tube; it has itself also a cock at its lower end, to regulate the supply of water which is to enter into it from the cistern. The use of this cross pipe is to set the apparatus at work at the commencement of its operations, which is effected, (after having filled the vessels and tubes with steam, by opening the communication with the steam-pipe, and having thereby blown all the air out of the apparatus) by opening the cock of the cross pipe, when the water will run directly from the cistern into the long descending tube (which has an enlarged cavity a little below the entrance of the cross pipe, to increase the effect of the cold water), where, and in the lower part of the long tube, coming in contact with the steam, it will instantly condense it, cause a vacuum, or an approximation to one, in the vessels and tubes, which, on again closing the cock of the cross pipe, will oblige the water from the cistern to rise through the ascending tube (its entrance at the bottom of the long descending tube being prevented by the valve placed there for that purpose), fill the vessels and tubes, and thereby set the siphon-principle to work to produce a stream round from the cistern, through the vessels and tubes, into the conduit or sewer at the bottom of all, which stream being regulated by the cock of the ascending tube so as to be just sufficient for the condensation of the steam which meets it in the internal vessel, will, in the opinion of the patentees, cause that approach to a vacuum in that vessel which it is their intention to produce.

As a variation to this plan, it is stated that where a supply of water can be obtained above the level of the condensing vessel, a descending tube may be placed for its conveyance into the bottom of the external vessel, instead of the ascending one from the lower cistern. Another variation, of less consequence, consists in forming a neck to the top of the internal vessel enclosing the steam tube as before-mentioned, but having holes in its sides for the passage of the cold water into the internal vessel, instead of the narrow annular interval between that tube and the top of the vessel, first directed for the same purpose.

We have long been of opinion that the air pump in condensing steam-engines formed a very serious drawback to the advantages obtained by the condensation, and have been surprised to see no notice taken of its amount, unless in terms much too general to be useful, in the numerous estimates of the powers of different engines which have been published. In many engines which we have seen, the area of the air pump was at least half of that of the working cylinder, which (after allowing for the greater proximity of its piston rod to the centre of motion of the beam, and taking into account that in double engines it acts only in the ascending strokes, or in half of the whole number made) would cause it to require a force to work it that, it appears to us, would be nearly equal to a fifth of the whole power of the engine; considering that it has to act against that near approach to a vacuum (or 15lbs. on every square inch of the surface of its piston) which, for his having discovered the means of producing it, by making the condensation in a vessel separate from the working cylinder, has conferred reiterated praises on Mr. Watt in most works which treat on the subject.

As to the importance of the object which the patentees have in view, it may be perceived by these observations that we entirely agree with them; and we therefore regret to remark a material circumstance, which they have unfortunately omitted to take into consideration in their plans, and which, we fear, will operate in totally defeating them, and this, most singularly, the very one which the air pump is provided to remove in Mr. Watt's engines; that is to say, *the air extricated from the water and the steam in the condenser*. Now in the apparatus of the patentees this very same extrication of air must occur; which air, rising to the top of the condensing vessels, will in the first instance stop the action of the siphon part, where that is used, and very shortly afterwards will, by occupying the place of the water in the long descending tube, cause its hydrostatic action on the engine also to terminate; reduce it to a mere conduit for the waste steam; and of course totally end all condensation.

Patent granted to THOMAS ROBINSON WILLIAMS, *of New Norfolk-street, Strand, Middlesex, Gentleman, for an improved lancet.* Dated July 16, 1825.

THIS lancet is so contrived that, by letting go a trigger, a spring forces its point downwards and sideways, to make the incision intended, and again retracts it into its case, to which latter there is a sliding part at its lower end, which regulates the depth of the incision.

The spring is a coiled spiral, like that of a watch, and works within a cylindrical cavity in a round metallic plate, that turns on an axis at its centre, to one side of which plate the upper end of the lancet blade is attached by a screw pivot; both these are enclosed in a thin case, through the bottom of which the point of the lancet protrudes, and is there confined, by stops at each side, to move within a limited space. At one side of this case the trigger is placed, moved by a little button which projects beyond the case, and whose point enters into notches in the edge of the round plate that encloses the spring, to retain it in different positions, as the plate is drawn round backwards by a little arm, that is fixed to it at one side for that purpose. The second part of the case before-mentioned slides on over the first from beneath, and is fastened to it by a small screw with a milled head, by which the situation of the two parts can be adjusted as thought proper. One side of this second and lower part of the case is formed of a thin flat spring, which presses against the side of the lancet, steadies its motion, and also prevents any fluid from penetrating into the interior of the case.

When this lancet is to be used, the spring is drawn back until the point of the trigger enters the first notch, when the lancet blade will be protruded to its greatest extent. The lower part of the case is then to be slided on over the upper part, so as to leave as much of the point of the lancet projecting as will be thought necessary for the intended incision; and the two parts being then secured together by turning the side screw, the spring is to be drawn round to the last notch in the circular plate, which causes the pivot, by which the upper part of the lancet is fastened to it, to pass upwards at the other side of the case, opposite to its first position, and thereby draws up the point of the lancet into the case, and prepares it for the operation.

The lancet, in this state, being placed firmly over a vein in the proper position, on letting go the trigger, by pressing its button, the point of its blade will be discharged downwards, and again drawn back by the upper end of the blade being moved back to its first place by the action of the spiral spring; and as this upper end, in thus passing backwards and upwards, moves sideways also, through the whole diameter of the circular piece that contains the springs, the point must make a corresponding lateral movement at the same time (which on account of the stops before-mentioned, at the lower part of the upper case, will be in a contrary direction to that of the pivot end of the blade), by which the length of the incision will be determined.

As the skin and other substances, through which the point of the lancet will have to penetrate in an operation, are of an elastic nature, the distance to which it will descend must be regulated by the degree of pressure given to the whole instrument by the operator, as well as by the extent to which the point is permitted to protrude beyond the case; for which reason, as the operation must depend on the dexterity and skill of the operator with this apparatus, as well as with a common lancet, we cannot perceive any advantage which it will have over that instrument.

The jerk of the spring, we conceive, would be rather injurious than useful; and if the point of the lancet being confined from penetrating beyond a given extent is of any benefit, we think this may be effected in a much more simple manner by a sliding stop on the blade of the common lancet itself. Altogether it seems to us an apparatus which very few surgeons would choose to use with their patients.

Society of Civil Engineers.

At the Anniversary Dinner of the Institution of Civil Engineers, on the 11th of May, the Secretary, Mr. Rutt, delivered an address, which, with the complimentary clauses usual on such occasions, containing matter tending to promote the improvement of the practical sciences and arts, an account of it will, we trust, be interesting to our readers.

The Institution has now existed for eight years in a progressively improving state; and sixteen new members were admitted in the preceding year, which raises the whole number to 130. It is not confined solely to those who are actively engaged in the profession, but is extended also to those whose studies have been directed to objects of a congenial nature.

The Society possess a valuable library, with numerous excellent maps and plans, and an extensive collection of manuscripts on interesting practical subjects, communicated by scientific gentlemen, all of which are open to the inspection and study of the members.

Those who are qualifying themselves by previous study for this most useful profession, will find material advantages in becoming members of the Institution, in the facility which it will afford them of associating with the more experienced members, who can direct their studies, solve their difficulties, and convey information to them valuable for its novelty as well as its utility. They will also be greatly assisted by the body of literary information, both printed and in manuscript, in the possession of the Society, which may be expected to increase rapidly in extent and value as this Institution becomes more known, which, with many other useful objects, will be greatly promoted by the publication of the valuable communications already made to the Society, which they have in contemplation, and the number of which they hope to increase considerably, by their determination to confer medals for the best treatises on subjects of importance connected with the profession and Institution.

Men of science, and experienced engineers, will also find great benefit in joining a Society for the promotion of a profession whose objects are so extensive and multifarious, that the wisest, most studious, and most laborious members of it, cannot flatter themselves with having sounded all its depths; and who, therefore, by mutual communication, may expect to acquire information on various points, which chance and diversity of genius facilitate to some, and withhold from others; and which will not only be of benefit to them indirectly, by increasing their knowledge, but may often serve to convey intelligence capable of the most immediate and beneficial application.

The extension of knowledge in all the particulars mentioned is very much promoted by the plan which the Society have adopted, of proposing questions for discussion on subjects interesting to the profession; the results of which are not lost, as by another useful regulation the opinions given respecting them are registered; by which a very useful work of reference is formed for the benefit of the members, to which they may have recourse whenever they may find occasion for its consultation.

Conceiving that practical science, as well as the views of the Society, may be promoted by giving publicity to the questions which have engaged their attention in their last session, we insert the following list of them :—

1. What has been the result of the last year's wear of the Macadamized roads in London?

2. What is the nature and cause of quicksands, like those of the Goodwin Sands, their actions and effect; how are the Goodwin Sands situated, and what would be the best mode of preventing accidents on the Goodwin Sands?

3. What is the best mode of casting large masses of metal perfectly sound?

4. What examples are there in this country which exhibit an advantageous effect of increasing the scour of rivers or harbour channels by artificial means?

5. What are the chemical properties of that efflorescent substance that so frequently exudes from the surface of brick walls, and also of some plastered walls; and is there any means known of preventing the destruction of paint when laid upon walls where that substance appears?

6. What is the weight of cokes resulting from the perfect carbonization of a given weight of different varieties of coal?

7. What is the best method of weighing the gases, or of obtaining the specific gravities of aëriform fluids in general?

8. What are the comparative advantages of making gas from oil when compared with mineral coal?

9. What experiments have been made on the stability of floating bodies, and which of the authors on this subject have treated it in a manner most applicable to practical purposes?

10. When a house is to be erected upon a bed of clay, what is the best method of building the same, so that all parts of the wall above the level of the ground shall be free from damp; and what are the best means of preventing the damp arising in the walls of houses after they are built upon a bed of clay?

11. What is the comparative cost of conveyance by

means of the common turnpike roads in proportion to the different rates of motion?

12. What is the greatest time that what has been called Parker's Roman Cement has been known to occupy in setting, and yet ultimately to become hard?

13. Is the metal used in the celebrated French draw plates simply a softened steel, or is it an alloy of iron with other metals?

14. What are the advantages and disadvantages of iron boats on canals compared with the wooden boats in ordinary use?

15. What have been the rates of motion in proportion to the different loads on board steam-boats?

16. What effect has the atmosphere upon the making of iron from the ore into what is called pig iron, and why is that made in winter superior to that made in summer?

17. What may be considered as the average power of a horse in this kingdom, expressed in the following terms: The force employed in lbs. weight; the rate of motion; the distance per day, reckoning six days per week, throughout the year?

18. What is the comparative cost of conveyance by the various animal powers usually employed?

19. What are the relative advantages in the employment of high pressure or low pressure steam, or which will produce the greatest effect with a given quantity of coals?

Some of these questions still remain for further discussion; others of them have been freely commented on, and will be laid by for the present; and for the purpose of obtaining all the information that the different members can furnish, a list of them will be transmitted to those members who reside in the country, with a request that they will furnish solutions as far as they are able and have opportunity.

The Institution has received the following original communications:—

1. A paper on the Principles of Tension, and the Resistance of Bodies to be torn asunder in the Direction of their Length. By Mr. Tredgold.

2. A paper showing the comparative Resistance between Vessels moving on Canals and Carriages on Rail-ways. By Mr. H. R. Palmer.

3. A Description of a new measuring Chain, with Sketches of the same, and a Model of one. By Mr. John Easton.

4. A paper on Coal and Coke, showing the Result of a year's working, both from Ovens and Retorts, at Ipswich. By Mr. William Cubitt.

5. An Account of the Eruption of Water and Bog from Craw Hill, between Keighley and Colne, which occurred on the 2d of September, 1824. By Mr. Josiah Parkes.

6. A paper on the Stability of Floating Bodies. By Mr. George Bidder.

7. A paper on the Stability of Floating Bodies, with a Table of Calculations, and a second Table, with a Description of the same. By Mr. A. G. Carlsund, of Carlscrona.

The address was concluded with a list of several valuable books and models lately presented to the Society by different gentlemen; an acknowledgment to Mr. Telford for the gift of the portrait of their President; and a notice that the Rules of the Society, lately printed, after a thorough revision, are now ready for delivery at their house in Buckingham-street, Strand.

LIST OF NEW PATENTS.

William Wood, of Summer Hill Grove, Northumberland, Gent. for an apparatus for destroying the inflammable air (which is commonly known by the name of fire damps) in mines.—Dated April 22, 1826.—(*Six months to enrol specification.*)

John Petty Gillespie, of Grosvenor-street, Newington, Surrey, Gent. for a new spring, or combination of springs, for the purpose of forming an elastic resisting medium.—Dated April 25, 1826.—(*Six months.*)

Samuel Brown, of Eagle Lodge, Old Brompton, Middlesex, Gent. for improvements on his former patent, dated December 4, 1823, for an engine or instrument for effecting a vacuum, and thus producing powers by which water may be raised and machinery put in motion.—Dated April 25, 1826.—(*Six months.*)

Francis Halliday, of Ham, Surrey, Esq. for an apparatus or machine for preventing the inconvenience arising from smoke in chimneys, which he denominates a wind guard.—Dated April 25, 1826.—(*Six months.*)

John Williams, of the Commercial Road, ironmonger and ships' fire-hearth manufacturer, for improvements on ships' hearths, and apparatus for cooking by steam.—Dated April 27, 1826.—(*Two months.*)

William Choice, of Strahan Terrace, auctioneer, and **Robert Gibson**, of White Conduit Terrace, builder, Islington, for improvements in machinery for making bricks.—Dated April 27, 1826.—(*Two months.*)

Charles Kennedy, of Virginia Terrace, Great Dover Road, Surrey, surgeon and apothecary, for improvements in the apparatus used for cupping.—Dated April 29, 1826. —(*Six months.*)

John Goulding, of America, but now residing in Cornhill, London, engineer, for improvements in the machines used for carding, stubbing, slivering, roving, or spinning wool, cotton, waste silk, short stapled hemp and flax, or any other fibrous materials or mixture thereof. —Dated May 2, 1826.—(*Six months.*)

Arnold Buffum, late of Massachusetts, America, but now residing in Jewin-street, London, hat manufacturer, and John M'Curdy, of Cecil-street, Strand, Esq. for improvements in steam-engines.—Dated May 6, 1826.—(*Six months.*)

Sir Robert Seppings, of Somerset House, London, for improvements in the construction of fids or apparatus for striking top-masts and top-gallant-masts in ships.—Dated May 6, 1826.—(*Six months.*)

William Fenner, of Bushell Rents, Wapping, carpenter, for an improvement in machinery or apparatus for curing smoky and cleansing foul chimneys.—Dated May 6, 1826.—(*Six months.*)

Alexander Allard de la Court, of Great Winchester-street, London, Esq. for a new instrument, and improvements in certain well-known instruments, applicable to the organ of sight.—Dated May 6, 1826.—(*Six months.*)

Joseph Schaller, of Regent-street, ladies' shoemaker, for improvements in the construction or manufacture of clogs, pattens, or substitutes for the same.—Dated May 6, 1826.—(*Six months.*)

Edward Heard, St. Leonard, Shoreditch, chemist, for a certain new composition or compositions, to be used for the purpose of washing in sea and other water.—Dated May 8, 1826.—(*Six months.*)

Levy Zachariah, jun. of Portsea, pawnbroker, for a combination of materials to be used as fuel.—Dated May 8, 1826.—(*Six months.*)

THE

REPERTORY

OF

PATENT INVENTIONS, &c.

SUPPLEMENT—JUNE, 1826.

Further Researches on the Preservation of Metals by Electro-chemical Means.

By Sir Humphry Davy, Bart. Pres. R. S.

(From the Philosophical Transactions of the Royal Society of London.)

Concluded from p. 376.

These results upon perfect and imperfect conductors led to another inquiry, important as it relates to the practical application of the principle; namely, as to the extent and nature of the contact or relation between the copper and the preserving metal. I could not produce any protecting action of zinc or iron upon copper through the thinnest stratum of air, or the finest leaf of mica, or of dry paper; but the action of the metals did not seem to be much impaired by the ordinary coating of oxide or rust; nor was it destroyed when the finest bibulous or silver paper, as it is commonly called, was between them, being moistened with sea water. I made an experiment with different folds of this paper. Pieces of copper were covered with one, two, three, four, five, and six folds; and over them were placed pieces of zinc, which were fastened closely to them by thread: each piece of copper so protected was exposed in a vessel of sea water, so that the folds of paper were all moist.

It was found, in the case in which a single leaf of paper was between the zinc and the copper, there was no corrosion of the copper; in the case in which there were two leaves, there was a very slight effect; with three, the corrosion was distinct; and it increased till with the six folds the protecting power appeared to be lost: and in the case of the single leaf there was this difference from the result of immediate contact, that there was no deposition of earthy matter; showing that there was no absolute minute contact of the metals through the moist paper; which was likewise proved by other experiments: for a thin plate of mica, as I have just mentioned, entirely destroyed the protecting effect of zinc; and yet when a hole was made in it, so as to admit a very thin layer of moisture between the zinc and copper, the corrosion of the copper, though not destroyed, was considerably diminished.

The rapid corrosion of iron and zinc, particularly when used to protect metals, only in very small quantities, induced me to try some experiments as to their electrochemical powers in menstrua out of the contact, or to a certain extent removed from the contact of air, such as might be used for moistening paper under the copper sheathing of ships. The results of these experiments I shall now detail. A small piece of iron was placed in one glass filled with a saturated solution of brine, which contains little or no air; copper, attached by a wire to the iron, was placed in a vessel containing sea water, which was connected with the brine by moistened tow. The copper did not corrode, and yet the iron was scarcely sensibly acted upon, and that only at the surface of the brine; and a much less effect was produced upon it in many weeks than would have been occasioned by sea water in as many days.

With zinc and brine in the same kind of connexion there was a similar result; but the solution of the zinc was comparatively more rapid than that of the iron, and the copper was rendered more highly negative, as was shown by a slight deposition of earthy matter upon it.

A solution of potassa, or of alkaline substances possessing the electro-positive energy, has nearly the same effect on saline solutions as if they were deprived of air, and when mixed with sea water impedes the action of metals upon them; but if used in quantity in combinations such as these I have just described, in which iron is the protecting metal, it destroys the result, and renders the iron negative. Thus, if iron and copper in contact, or fastened to each other by wires, be in two vessels of sea water connected by moist cotton or asbestos, all the various circumstances of protection of the two metals by each other may be exhibited by means of solution of potassa. By adding a few drops of solution of potassa to the water in the glass containing the iron, the negative powers of the copper in the other glass are diminished; so that the deposition of the calcareous and magnesian earths upon it is considerably lessened: by a little more solution of potassa the deposition is destroyed, but still the copper remains clean. The corrosion of the iron, which before was rapid, is now almost at an end, and a few drops more of the solution of potassa produces a perfect equilibrium; so that neither of the metals undergoes any change, and the whole system is in a state of perfect repose. By making the fluid in the glass containing the iron still more alkaline, it no longer corrodes; and the green tint of the sea water shows that the copper is now the positively electrified metal; and when the solution in the glass containing the iron is strongly alkaline, the copper in the other glass corrodes with great rapidity, and the iron remains in the electro-negative and indestructible state.

I began this paper by some observations upon the nature of the processes by which copper sheeting is destroyed by sea water, and on the causes by which it is preserved clean, or rendered foul by adhesions of marine vegetables or animals; I shall conclude it by some further remarks on the same subject, and with some practical inferences and some theoretical elucidations, which naturally arise from the results detailed in the foregoing pages.

The very first experiment that I made on harbour-boats at Portsmouth, proved that a single mass of iron protected fully and entirely many sheets of copper, whether in waves, tides, or currents, so as to make them negatively electrical, and in such a degree as to occasion the deposition of earthy matter upon them: but observations on the effects of the single contact of iron upon a number of sheets of copper, where the junctions and nails were covered with rust, and that had been in a ship for some years, showed that the action was weakened in the case of imperfect connexions by distance, and that the sheets near the protector were more defended than those remote from it. Upon this idea I proposed, that when ships, of which the copper sheathing was old and worn, were to be protected, a greater proportion of iron should be used, and that if possible it should be more distributed. The first experiment of this kind was tried on the Sammarang, of 28 guns, in March 1824, and which had been coppered three years before in India. Cast-iron, equal in surface to about $\frac{1}{80}$ of that of the copper, was applied in four masses, two near the stern, two on the bows. She made a voyage to Nova Scotia, and returned in January 1825. A false and entirely unfounded statement respecting this vessel was published in most of the newspapers,—that the bottom was covered with weeds and barnacles. I was present at Portsmouth soon after she was brought into dock: there was not the smallest weed or shell-fish upon the whole of the bottom from a few feet round the stern protectors to the lead on her bow. Round the stern protectors there was a slight adhesion of rust of iron, and upon this there were some zoophytes of the capillary kind, of an inch and a half or two inches in length, and a number of minute barnacles, both Lepas anatifera and Balanus Tintinnabulum. For a considerable space round the protectors, both on the stern and bow, the copper was bright; but the colour became green towards the central parts of the ship; yet even here the rust or verdigrease was a light powder, and only small in quantity, and did not adhere, or come off in scales, and there had been evidently little copper lost in the voyage. That the protectors had not been the cause of the trifling and perfectly insignificant adhesions by any electrical effect, or by occasioning any deposition of earthy matter upon the copper, was evident from this,—that the lead on the bow, the part of the ship most exposed to the friction of the water, contained these adhesions in a much more accumulated state than that in which they existed near the stern; and there were none at all on the clean copper round the protectors in the bow; and the slight coating of oxide of iron seems to have been the cause of their appearance.

I had seen this ship come into dock in the spring of 1824, before she was protected, covered with thick green carbonate and submuriate of copper, and with a number of long weeds, principally fuci, and a quantity of zoophytes, adhering to different parts of the bottom; so that this first experiment was highly satisfactory, though made under very unfavourable circumstances.

The only two instances of vessels which have been recently coppered, and which have made voyages furnished with protectors, that I have had an opportunity of examining, are the Elizabeth yacht, belonging to the Earl of Darnley, and the Carnebrea Castle, an Indiaman, belonging to Messrs. Wigram. The yacht was protected by about $\frac{1}{145}$ part of malleable iron placed in two masses in the stern. She had been occasionally employed in sailing, and had been sometimes in harbour, during six months. When I saw her in November she was perfectly clean, and the copper apparently untouched. Lord Darnley informed me that there never had been the slightest adhesion of either weed or shell-fish to her copper, but that a few small barnacles had once appeared on the loose oxide of iron in the neighbourhood of the protectors, which however were immediately and easily washed off. The Carnebrea Castle, a large vessel of upwards of 650 tons, was furnished with four protectors, two on the stern and two on the bow, equal together to about $\frac{1}{107}$ of the surface of the copper. She had been protected more than twelve months, and had made the voyage to Calcutta and back. She came into the river perfectly bright; and when examined in the dry dock was found entirely free from any adhesion, and offered a beautiful and almost polished surface; and there seemed to be no greater wear of copper than could be accounted for from mechanical causes.

Had these vessels been at rest, I have no doubt there would have been adhesions, at least in Portsmouth or Sheerness harbours, where the water is constantly muddy, and where the smallest irregularity or roughness of surface, from either wear, or the deposition of calcareous matter, or the formation of oxides or carbonates, enable the solid matter floating in the water to rest. There is a ship, the Howe, one of the largest in the navy, now lying at Sheerness, which was protected by a quantity of cast-iron, judged sufficient to save all her copper, nearly fifteen months ago. She has not been examined; but I expect and hope that the bottom will be covered with adhesions, which must be the case if her copper is not corroded: but notwithstanding this, whenever she is wanted for sea, it will only be necessary to put her into dock for a day or two, scrape her copper, and wash it with a small quantity of acidulous water, and she will be in the same state as if newly coppered.

At Liverpool, as I am informed, several ships have been protected, and have returned after voyages to the West Indies, and even to the East Indies. The proportion of protecting metal in all of them has been beyond what I have recommended, $\frac{1}{90}$ to $\frac{1}{70}$; yet two of them have been found perfectly clean, and with the copper untouched after voyages to Demerara; and another nearly in the same state, after two voyages to the same place. Two others have had their bottoms more or less covered with barnacles; but the preservation of the copper has been in all cases judged complete. The iron has been placed along the keel on both sides; and the barnacles, in cases where they have existed, have been generally upon the flat of the bottom; from which it may be concluded, that they adhered either to the oxide of iron, or the calcareous deposits occasioned by the excess of negative electricity.

In the navy the proportion adopted has been only $\frac{1}{150}$ of cast-iron, at least for vessels in actual service, and when the object is more cleanness than the preservation of the copper.

It is very difficult to point out the circumstances which have rendered results, such as these mentioned with respect to Liverpool traders, so different under apparently the same circumstances, i. e. why ships should exhibit no adhesions or barnacles after two voyages, whilst on another ship, with the same quantity of protection, they should be found after a single voyage.* This may probably depend upon one ship having remained at rest in harbour longer than another, or having been becalmed for a short time in shallow seas, where ova of shell-fish or young shell-fish existed; or upon oxide of iron being formed, and not washed off, in consequence of calm weather, and which consolidating, was not afterwards separated in the voyage. From what I can learn, however, the chance of a certain degree of foulness, in consequence of the application of the full proportion of protecting metal, will not prevent ship-owners from employing this proportion, as the saving of copper is a very great object; and as long as the copper is sound, no danger is to be apprehended from worms.

It ought to be kept in mind that the larger a ship, the more the experiment is influenced by the imperfect conducting power of the sea water, and consequently the proportion of protecting metal may be larger without being in excess.

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* The quality of the copper may be another cause.

I have mentioned these circumstances because they apply to ships already coppered, and because I have heard that a Liverpool ship, of which it was doubtful whether the copper was in a state such as would enable her to make another voyage to India with security has, by the application of protectors of $\frac{1}{70}$, made this voyage,* without apparently any wear of her sheeting; and that she is now preparing with the same protectors to make another voyage.

In cases when ships are to be newly sheathed, the experiments which have been detailed in the preceding pages render it likely, that the most advantageous way of applying protection will be under, and not over the copper: the electrical circuit being made in the sea water passing through the places of junction in the sheets; and in this way every sheet of copper may be provided with nails of iron or zinc, for protecting them to any extent required. By driving the nail into the wood through paper wetted with brine above the tarred paper, or felt, or any other substance that may be employed, the incipient action will be diminished; and there is this great advantage, that a considerable part of the metal will, if the protectors are placed in the centre of the sheet, be deposited and re-dissolved: so there is reason to believe that small masses of metal will act for a great length of time. Zinc, in consequence of its forming little or no insoluble compound in brine or sea water, will be preferable to iron for this purpose; and whether this metal or iron be used, the waste will be much less than if the metal was exposed on the outside; and all difficulties with respect to a proper situation in this last case are avoided.

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* The Dorothy.

The copper used for sheathing should be the purest that can be obtained; and in being applied to the ship, its surface should be preserved as smooth and equable as possible; and the nails used for fastening should likewise be of pure copper, and a little difference in their thickness and shape will easily compensate for their want of hardness.

In vessels employed for steam navigation the protecting metal can scarcely be in excess,* as the rapid motion of these ships prevent the chance of any adhesions; and the wear of the copper by proper protection is diminished more than two-thirds.

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* I have mentioned in the two last communications on this subject some application of the principle; many others will occur. In submarine constructions—to protect wood, as in piles, from the action of worms, sheathing of copper defended by iron in excess may be used; when the calcareous matter deposited will gradually form a coating of the character and firmness of hard stone.

Description of Cast-iron Trusses or Cradles, for sustaining decayed or sunken Timbers.

By Mr. Alfred Ainger, *Everett-street, Russell-square.*

Concluded from p. 381.

From the Transactions of the Society of Arts, &c. Vol. xlii.

The large Gold Medal was presented by the Society to Mr. Ainger for this invention.

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WITH AN ENGRAVING.

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It has been shown before that the tension on the limb *b e*, and on the corresponding limb on the other side, is equal to one and a quarter times the whole load; equal, therefore, in this experiment, to seven and a half tons. But as two cast-iron bars, having each a sectional area of 1.6 inches, will sustain upwards of twenty-two tons, the load might have been increased to somewhat more than

$\frac{22}{1.25}$ or eighteen tons. This would, however, be approaching too nearly the breaking point for practice. One half the weight that would produce fracture is generally considered the largest load to which any material should be permanently exposed. One half, therefore, of eighteen tons is the greatest weight that these trusses should constantly bear. It is almost needless to add that their strength may be increased, as circumstances require, without limit.

The size of the ears will of course require no less consideration than that of the limbs. Those at *e* sustain the greatest weight, which may be thus ascertained :—suppose the two limbs, *b e* and *c d*, to form one lever, *d* being the fulcrum, *b* the place of the power, and *e* that of the weight. The power, as already shown, is half the whole load, or $\frac{\mathrm{W}}{2}$; the limb, *b e*, was twenty-five inches, and *c d* twenty inches; the whole length of the lever, therefore, forty-five inches, and the pressure on the ears at *e* equal to $\frac{45}{20} \times \frac{\mathrm{W}}{2}$, or 1.125 w, being somewhat less than that which the limbs *b e* receive. But as the ears are more exposed to sudden shocks, especially in fixing, they should be made at least equal to the limb; and in this case they were so, being made as much wider than the limb as the width of the bolt-hole; that is to say, they were two and a half inches wide, and pierced with a hole half an inch wide. The quantity of metal below the bolt was one and a half times that on each side.

The bolts were two inches by half an inch; and the bottom of the groove in the plates being made rather hollow from end to end, caused the bolts to rest only at the extreme edges of the plates, and gave to them all the strength of which they were susceptible.

As in most of the cases to which these trusses would be applicable it is requisite that they should not occupy a space much greater than the depth of the timber itself;

in all these the cast-iron grooved plate and the bolt may be advantageously exchanged for a wrought-iron plate, terminating in a screw bolt at each end, and the plate may be cut into the surface of the timber as much as circumstances render necessary. This will be understood by the description of the other trusses in which such plates are introduced.

It has been objected, and perhaps may again be so, that the oak wedges are liable to become infected by the rot and to decay. It would be a very short answer, and one involving no difficulty nor much expense, to say, use iron; but the fact is, that iron would give no advantage to counterbalance the convenient facility with which wooden wedges are made to accommodate themselves to irregularities in the size or surface of the timber. It will be observed that there are no wedges at *e*, those at *c* are not at all concerned in supporting the weight, and those at *d* are so far removed from the seat of the disorder that before it could materially affect them the beam must drop from its rottenness at *e*. Farther than this,—as the wedges should be of new good oak it is hardly possible that they should become worse or even so bad as that part of the beam immediately under them; still less likely are they to become so bad as the timber of the beam at *e*, which receives a pressure more than double that to which the wedges are exposed.

All this, however, would be no argument for the use of pieces of oak bolted to the sides of the beams, because the ends of those pieces next to the wall would inevitably receive the infection; and as the support they give depends on the adhesion of their fibres even to the extremity, they immediately begin to lose strength. Besides which, the destruction of the lateral cohesion and tenacity of the fibre is the first effect of the dry rot, and takes place long before the wood has lost the power of supporting a considerable weight pressing on its surface.

In regard to expense the advantage is greatly in favour of the iron; the whole weight of cast-iron at each end was one hundred and twenty-six pounds, and of wrought-iron twelve pounds. The cast-iron was supplied at 14*s.* per cwt. and the wrought-iron at 6*d.* per pound. The expense of fixing, as has already been stated, is scarcely appreciable. If this be compared with the value of two pieces of oak, each six feet long, twelve inches deep, and four inches thick, together with three or four screw-bolts, weighing nine or ten pounds each; and if to this be added the difficulty and risk of boring bolt-holes in timber so situated, the difference will be found to be in the ratio of not less than two to one.

Figs. 5 and 6, of the same plate, are a side and end view of the truss or cradle designed for the principal rafters and tie-beams. In this truss there is a peculiarity arising from the circumstance that the width or thickness of the rafter is generally less than that of the tie-beam, as shown in fig. 6, and this requires that the limbs of the truss should not form straight lines, but that, in passing from the tie-beams on to the rafter, each should deviate half the difference of thickness of these two: that deviation is made where the bolts *n* and *o* pass through, in order that no loss of strength may be occasioned. The tie-beam rests upon a large wrought-iron plate, terminated at each end in a screw-bolt, as was suggested in reference to the former case, thus saving the depth occupied by detaching the bolt from the plate. The edges, *r r*, of the trusses are made thicker on the inner faces, and are cut into the sides of the rafter, as shown at fig. 7. At *q* there is a cast-iron plate, and a bolt with wedges similar to those before described, the tightening of which brings the plate *p* against the underside of the tie-beam. The action of the truss is as follows:—the perpendicular weight is sustained on the same principle as in the first case, by the two opposing pressures at *p* and *q*, through the intervention of the strut *m*, which is introduced for the purpose; the lateral thrust is resisted by the edges *r r*, cut into the sides of the rafters; and less directly, but more powerfully, by the bolt, plate, and wedges at *q*, as may be understood by considering that any tendency to lateral motion in that part of the rafter at *q* must describe a circle, having the strut *m* for radius, and its lower end for a centre; the inclination of *m* from the perpendicular gives, therefore, to the rafter, a tendency to move somewhat upwards in opposition to the bolt, plate, and wedges at *q*, and of consequence to the whole weight of the roof acting on the plate *p*. The two pressures, therefore, one arising from the actual weight of the rafter and it's load, the other from its lateral thrust, are made to oppose and to annihilate each other as far as any tendency to derange the parts of the framing is concerned, and the whole is reduced to a simple perpendicular action on the wall through the feet of the truss. A cast-iron plate and wedges are put under the bolt at *o*, which has the effect of tightening the whole and of supporting the tie-beam, if it should ever be required temporarily to remove the rafters. The bolt, *n*, is merely for connection with the rafter, and for maintaining the strength of the truss where it deviates from the straight line: *y y*, in fig. 5, is the line of section in fig. 6, and *z z* in that of fig. 7.

The same principles of calculation as those applied in the last case will determine the requisite strength of the several parts, and the saving of expense, as compared with any possible way of accomplishing the same object by oak blocks bolted to the timbers will be found to be in a still greater ratio; probably as three or four to one.

Figs. 8 and 9, of the same plate, describe a mode of raising and sustaining a sunken or broken girder, requiring the exposure of not more than four or five feet of the upper surface, and not at all disturbing the cieling. The cast-iron truss consists of two similar pieces, each composed of two triangles and a square or parallelogram, the lower part of which supports a wrought-iron plate, with two screws at each end (shown separately at *s s*). Two smaller plates with screws bear on the top of the girder at *t* and *u*. The underside of the girder is notched to admit the plate *s s*, and it may be partially cut through at the top; then driving wedges between the plate *s s* and the timber, the centre of the girder will be raised to any required height, and will remain so.

Description of an Original Screw.

By Mr. G. Walsh, of Mount-street, Walworth Common.

From the Transactions of the Society of Arts, &c. Vol. xliii.

The Silver Vulcan Medal and Ten Guineas was given to Mr. Walsh for this communication.

WITH AN ENGRAVING.

The Society have for some few years offered a premium for a method for generating an original screw more perfect than any hitherto known. Several claimants have come forward; but the Society have not as yet thought themselves justified in awarding the premium, on account of the actual imperfections of the screws produced, and the inadequacy of the means employed to obtain a correct result. The screw made by Mr. Walsh, when examined by a micrometer, appears to be erroneous to the amount of no more than 1-250 of an inch in thirty-four threads; and, therefore, though not fit for astronomical purposes, may, however, be very advantageously applied to other uses. The ingenious simplicity of the apparatus by which it was made, not requiring the use of a screw-engine with guide screw, wheel work, slide rest, &c. is also a circumstance worthy of notice, as offering to the artizan of adequate skill, but contracted pecuniary means, facilities of good work which hitherto have not been in his power.

In Pl. XIII, fig. 10, *a a* represents a cylinder of softened steel, which is to be cut into a screw.

The first step is to turn a short cylinder of soft steel exactly twice the diameter of the intended screw. This is then to be fitted on an arbor in the lathe, and, by means of a common screw-tool of the required number of teeth, is to be cut into a double threaded screw, and is then to be hardened: of this latter screw, *b b*, fig. 11, represents a lateral and a front view.

Another short cylinder of soft steel is then to be made of exactly the diameter of the intended screw; it is then to be fitted on a pin, and put into the frame, *d d*, fig. 10. In this situation it is to be pressed hard against the cylinder *b*, fig. 11, while revolving in the lathe, until a good thread is raised on its surface. The thread thus formed will be a single thread, though taken from a double one, because during the process it revolves in proportion to the larger cylinder as two to one; it will also be a left-handed thread, because taken by impression from a right-handed one. After a few revolutions of the cylinder *c*, the frame in which it is held is to be turned upside down, and the same number of revolutions are to be made with the frame in this position, by which alternation the thread will be kept quite perpendicular to its axis, and the more the two cylinders are worked together, the more will the cylinder *c* be free from the errors of the first cylinder *b*. Being completed, it is then to be hardened, and is again to be put into the frame *d d*. The cylinder *a a* being put into a lathe, the screw *c c* is to be pressed hard against it, in the manner of a milling tool, beginning on the right hand: when it has made a sufficient impression or lead, it is to be shifted one thread towards the left hand, the following threads of the screw always working in the preceding impression, which serves as their guide; this is to be continued till the whole cylinder is impressed with the lead of a screw (as shown in fig. 10), which will of course be right-handed, because the impressing screw is left-handed. The lead thus obtained is to be eased or cut deeper by the pointed tool *e e*, and is then to be finished by the screw *c*, taking care, as before directed, to reverse the frame *dd* from time to time.

To make a left-handed screw to suit a given right-handed one, tap a cylinder of steel in the same dies, and of the same diameter as the given screw, and turn each end down to a pivot, as *ff*, fig. 13, and harden it; drop it in the open frame *gg*, fig. 14, (fig. 15 is an end view of the same) and work it hard against the prepared cylinder exactly as described above for the original screw, by which a left-handed lead will be obtained, which is to be deepened with the point tool and finished by the roller *ff* as before.

When this screw is obtained it may be hardened, and left-handed dies may be made from it.

Description of a Screw-Wrench.

By Mr. Francis Watt.

From the Transactions of the Society of Arts, &c. Vol. XLII.

The sum of Ten Guineas was presented to Mr. Watt for this communication.

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WITH AN ENGRAVING.

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The screw-wrench is a kind of lever-vice, and is an extremely convenient tool for securing and loosening square headed screws, and for other similar purposes. The moveable chap of the instrument is secured at any required distance from the fixed one, sometimes by means of a screw, and sometimes by means of a short wedge driven in at the base of the sliding bar. To both these methods, however, as usually applied, there are objections, arising from the liability of the former to be injured, and of the latter to give way under the great strain which is sometimes put upon the instrument.

Mr. Watt's wrench is represented plate XIII, fig. 16.

i i is the fixed bar, terminated by the fixed chap *h* : *jjj* is an iron case, enclosing and fixed firmly on the bar *i i* : *k* is the sliding chap, having a hole cut in it for the bar *i i* to pass through, and secured to the sliding bar *l l*. It will be observed that the lower end of this bar is cut off very obliquely, so as to form a long low wedge. *m n* is a low wedge, still longer than that just described.

In order to make use of the instrument, the wedge *m n* is to be withdrawn; the chap *k* is to be moved on the bar *i i*, till the screw head, or other object to be acted on, is closely embraced between the two chaps; the moveable wedge is then to be inserted point foremost, and is to be driven home by a light blow or two of a hammer, or may be forced in sufficiently even by hand.

The long line of bearing that the two wedges have on each other renders it impossible that they should give way, while, at the same time, a very moderate blow on the point of the moveable wedge will be sufficient to disengage it.

It is by no means absolutely necessary to take out the moveable wedge previous to adjusting the instrument; all that is required being that the sliding bar *l l* should move easily.

It will therefore be found convenient to drill a hole through the point of the wedge at *m*, and insert a small pin, in order to prevent the wedge from slipping out of the case *j j*, and being lost.

Physico-Chemical Researches on Charcoal.

By M. Chevreusse, Professor of Chemistry at the Royal School of Artillery and Engineering. *Annales de Chimie, Aout,* 1825.

Concluded from p. 398.

Of the Hygrometric Property.

Charcoals, considered with regard to their power of absorbing aqueous vapours, may also be distinguished into two classes, although always produced from the same wood, as will be seen.

I took two charcoals of poplar, one in the first state of carbonization, and the other in the second. These two charcoals were made exactly of the same thickness; they were then deprived of their humidity, but not of the air which they contained, in order to make these experiments coincide with the operations of gunpowder manufactories.

The two charcoals of this light wood, well dried, were weighed and placed in a vessel, the air of which was humid, and in which the hygrometer indicated its *maximum;* every 24 hours the charcoals were weighed, and these weighings were continued during a month.

These same operations were repeated on charcoals of hard wood, that of guiacum in the two states of carbonization and perfectly dry. I will only point out, in the following table, the results obtained on the first, the third, the eighth, and the thirtieth day, the intermediate observations having little interest.

I also wished to determine the absorption of water in its liquid state by these charcoals; and for this purpose, after having completed the experiments in the humid air, the four charcoals were saturated by a prolonged immersion in water.

The Quantities of Water absorbed by 100 *Parts of Charcoal.*

		Duration of the exposure to moist air.				Saturated with water by immersion.
		1st day	3d day	8th day	30th day.	
Charcoal of Poplar	1st Carbonization	0·176	0·235	0·235	0·235	752·94
	2d Carbonization	0·153	0·230	0·230	0·235	482·08
Charcoal of Guiacum	1st Carbonization	0·058	0·082	0·082	0·119	77·24
	2d Carbonization	0·021	0·040	0·058	0·094	45·98

In comparing the results exhibited in this table, the charcoals of light wood and of dense wood will be seen, in their first state of carbonization, to have absorbed a greater quantity of water than the same charcoals in their second state, and that this absorption took place more speedily with the first than with the second, which nevertheless in time became charged with the same quantity of humidity.

It is also of importance to know if charcoals of the same wood, prepared by the two modes of carbonization, absorb in the same manner when they are reduced to powder. Experience shows that the absorption exercised by the charcoal of poplar in the first state of carbonization, is performed more rapidly than that by the powder of charcoal of the same wood in the second state of carbonization. The two charcoals, pulverized, always became saturated in time with the same quantity of water, which was found to be less than that which the same charcoal, in an entire state, could absorb.

Thus it results also from these different experiments on absorption, that charcoals, prepared with the same wood, but by different exposures to the action of fire, may be considered as in two distinct classes.

Of the Combustibility.

The combustible property of charcoals has not hitherto been examined but with regard to the species of vegetables which have furnished them ; but the experiments which I am going to recite, prove evidently that the state of carbonization of a charcoal is a principal cause of variation in this property, so much sought for in the charcoal destined for the fabrication of gunpowder.

If a small cylinder of the charcoal of black alder, in its first state of carbonization, be exposed to the action of the flame of a candle, it grows red and burns at the heated end, and the combustion continues as long as it is exposed to the air.

If the same operation is repeated with a cylinder of charcoal, also of black alder, but in its second state of carbonization, it grows red and burns with difficulty, and when it is exposed to the air it quickly becomes extinguished.

The charcoal in the first state of combustion, being plunged into oxygen gas, burns brilliantly, whilst the combustion of the other sort of charcoal is less rapid; this difference of combustibility is rendered very apparent by the following experiment:—Two charcoals, in the two different states of carbonization, are to be formed into equal cones by a file; each of these two pieces is to be fixed on one end of a wire, and the two other extremities of these wires are to be thrust into a piece of cork, in such a manner that the bases of the two cones may be opposite, at the same height, and without coming in contact.

After having made the tops of the two cones red hot at the same time, they are to be introduced into a jar of oxygen gas, mixed with atmospheric air, in equal proportions, care being taken not to close the jar entirely. It will be remarked in this experiment, that the combustion appears to be equal in the two pieces of charcoal at the commencement of the operation; but that in a short time the flame disappears from the surface of the charcoal in the second state of carbonization, and that it remains red without burning with a vivid light; whilst at the same moment the charcoal of the first carbonization is entirely consumed.

The greater affinity of oxygen for charcoals in the first state of carbonization than for the others, is further proved by the decomposition of water, which is more easily effected by the first than by the second, as the simple experiment will show which I am going to relate.

Two pieces of charcoal, formed of the same piece of black alder, one in the first state of carbonization, and the other in the second, after being slightly moistened are to be put down into an earthen crucible, filled with sand, which is to be immediately made red hot. If after it is cool the charcoals are sought for, it will be remarked that the one in the first state of carbonization is entirely destroyed, and that it is replaced by only a few traces of the remains of its combustion, whilst the charcoal in the second state remains without alteration.

Without anticipating what I intend hereafter to publish on the combustibility of charcoals with regard to the vegetable species, the mode of carbonization, &c. we may infer from the experiments recited, that charcoals of the first carbonization are more combustible than the others, when they are formed of the same sort of wood.

We may also conclude from these latter experiments, that charcoals may be ranged in two classes, as well with regard to their combustibility as to the other properties which we have already examined.

General Conclusion and Application.

On examining the facts contained in this memoir, it will be seen that their object is to fix the attention on the properties of charcoal, which ought to interest the gunpowder nanufacturers.

Carbonization.—I have here shown that substances capable of being converted into charcoal may produce charcoals of different qualities, according to the quantity of caloric employed in making them; which has led me at present to arrange all charcoals into two principal classes, according to the greater or less advanced state of their carbonization, in consequence of the charcoals of those two classes having properties diametrically opposite.

Conductibility for Electricity.—I have then considered these two sorts of charcoal with respect to their property of conducting electricity, and experience has proved that a charcoal of the first class is not a conductor of electricity when in a dry state, whilst a charcoal belonging to the second class is a perfect conductor.

I have made evident the advantage of employing zinc for examining before-hand whether a charcoal was a conductor of electricity.

In seeking to know the charcoals whose conductibility was greatest, I have found that this property is at its *maximum* in those which have been most heated, as is easy to be perceived in those charcoals which have fallen out from the high furnaces. The electricity which these charcoals exhibit in their contact with zinc, places them above silver for this effect.

These applications naturally follow from the foregoing observations:—1st, That it will be possible to compose electrical piles, which will be more economical and better than those in use, by substituting, for copper, charcoals from the high furnaces, and others which have been exposed to an elevated temperature.—2dly, An application not less important is, that whenever it is desired to transmit electricity to the earth, as in the erection of lightning-conductors, it will be advantageous to use these latter charcoals, which in case of a deficiency may be replaced by coke, as being much better than the common wood-charcoal obtained by a process analogous to that by which small coal (*braise*) is procured.

Conductibility for Caloric.—Charcoals produced from the same substance in their first and in their second state of carbonization, have also exhibited opposite characters relative to their conductibility for caloric. A very important fact may be here remarked,—that the charcoals which conduct electricity are precisely those which conduct caloric.

Since the conducting faculty of charcoal for electricity and caloric is the same for all charcoals in their second state, it will be easy to verify those properties the one by the other: thus, the application of zinc will indicate at once if a charcoal can serve as a conductor of caloric, in a variety of circumstances which are not important to recite here.

Density.—I have also determined the density relative to the two species of charcoals, which hitherto has only been examined in those of the different sorts of wood, and I have found that charcoals in the first state of carbonization are generally less dense than those in the second state.

Absorption of Humidity.—The absorbent faculty which charcoals possess for humidity has also been the subject of my researches. I have demonstrated,—

1st, That charcoals of the same wood, in the two different states of carbonization, absorb, in time, the same quantity of humidity when they are exposed to saturated air.

2dly, That this absorption is always more speedy in charcoals in the first state of carbonization than in the others.

3dly, That entire charcoals absorb so much more water as their density is less.

4thly, Finally, that charcoals in a state of division have the same properties as before their pulverization, but that the quantity of water absorbed by them is less.

From these facts we may perceive, that if charcoal be employed as an absorbent substance, it will be better, in some circumstances, to give the preference to charcoals in the first state of carbonization made from light wood not pulverized.

Combustibility.—The men of science who have examined the combustibility of charcoals have confined themselves to the statement of the differences which they have observed in burning charcoal from different substances, notwithstanding the interest which their labours excite, an evident omission may be observed in them, in their no stating the degree of carbonization of the charcoals used in their experiments.

The object which I have proposed at present is only to make manifest the great difference in combustibility, which exists between two charcoals of the same substance, in the extreme limits of carbonization, and experience has made known, that the combustion of charcoal in the first state of carbonization is more easy to be effected than that of charcoal of the same wood in the second state.

It would doubtlessly be important to demonstrate the scale of combustibility of the same charcoal taken at its first point of carbonization, and followed in the different states through which it passes before it enters its *maximum* of temperature.

I propose hereafter to publish this labour, the execution of which is equally long and delicate, when the different species of charcoals are desired to be submitted to examination.

Such are the results of the attempts which I have made to study the properties of charcoals, and from which we ought to divide into two great classes all the carbonaceous substances belonging to every single species.

In the first I arrange all the charcoals obtained in the first state of carbonization, which are at the same time the least dense, the worst conductors of electricity and of caloric, the most combustible, and the most rapidly absorbent of humidity.

In the second I place all the charcoals which have been exposed to a high temperature, or which are found in the second state of carbonization, which are at the same time the most dense, the best conductors of electricity and of caloric, the least combustible, and the most slowly absorbent of atmospheric humidity, although saturating themselves in time to the same degree.

In an ensuing memoir, wherein I will examine the chemical properties of charcoal, I will explain the causes to which are owing the change of state which has been the subject of the present communication.

ACCOUNT OF NEW PATENTS.

Patent granted to JONATHAN DOWNTON, *of Blackwall, Middlesex, Shipwright, for improvements in water closets.* Dated June 18, 1825.

THE chief peculiarity of the water closet of the patentee lies in the use of a pump for drawing off the contents of the pan, and forcing them away again through a tube into the sewer, or other external receptacle. This pump is placed near the pan, and is worked by a lever, whose centre of motion is at the opposite side of the pump to that part to which the hand is applied. A bent tube, of about the same diameter as the pump, passes from the bottom of the pan to the lower part of the pump; and another tube of the same size passes from the same part of the pump to the sewer, which tube may either be made to ascend, descend, or go off horizontally, or in any other direction which may be convenient. Two valves are placed in the bent tube, which is between the pump and the pan, one next the former, and the other adjoining to the latter, both of which valves open towards the pump; and in the other tube, which leads to the sewer, there is a single valve near the pump. A pipe for the conveyance of water runs down from a reservoir, and entering the pan at one side passes round horizontally across the line of the pump, in which part it has a cock, whose handle is worked by a jointed bar, that descends from the pump lever in such a manner as to open the cock when the piston is being raised, and to close it again as this descends, which position of the cock within the pan the patentee notices several times, as a matter of importance.

The pump being a forcing pump, and its lower part alone operating for the purposes mentioned, the part above the piston, which would otherwise be unemployed, is applied by the patentee as an air pump for drawing the air from the pan, and driving it into the evacuating tube;

which is performed by having a close cover screwed on the top of the pump, and passing the piston rod out through a stuffing box in its centre, while a pipe, with a valve opening from the pan, passes from the top of this latter to the upper part of the pump; from whence, at the opposite side, another pipe, with a valve opening outwards, goes into the discharging tube; and from the upper part of the pan a third pipe passes into the open air; by which pipes and valves altogether, when the pump is worked, and the cover put down close on the pan, the air will be drawn through it into the upper part of the pump, and from thence forced off into the discharging tube. An opening is made at the side of the large bent tube, near the pump, by which it may be cleaned when necessary, and which is fitted with an air-tight cover, that is screwed on at all other times.

The chief objection to this apparatus would arise from the necessity of working the pump for clearing the pan whenever it were used, the labour of which would probably cause it often to be omitted. The adhesion of the contents of the pan to the inside of the pump and to the valves, would also be likely to cause offensive odours, which could not be overcome by the air pump and water pipe; all which, added to its complication, would most probably give the common water closets a preference to it in public estimation.

Patent granted to JOHN HOBBINS, *of Walsall, Staffordshire, Ironmonger, for improvements in gas apparatus.* Dated June 22, 1824.

THE gas apparatus described in the specification of this patent consists of a gas retort, and vessels for purifying the gas, of a peculiar construction.

The retort is composed of three parts, two end pieces and a body, put together, by flanches cast on them, with screws and nuts; the fire only acts on the body, and the end parts are never affected by it, so that they remain in good order, fit for several successive bodies, as the former ones are burnt out. The end part, by which the coals are conveyed into the retort, is a piece of the same form as the body, about as long as its diameter, above which a hopper or short tube of the same diameter rises, which has a door or stopper on its upper part, through which the coals are put down, and which is closed gas-tight, and secured by a bar fastened across its middle. A moveable partition is placed across the horizontal portion of this end piece, of the shape of its section (which is nearly that of a semicircle with the diameter downwards), and from the centre of this partition a long iron bar proceeds horizontally through a tube, about ten inches long, in the end of the piece; a cross bar is placed at the extremity of the bar, and by it the moveable partition can be pushed in from the end piece to the far end of the body. The end piece at the other extremity of the body is, where it joins to it, of the same shape, and of about the length of its diameter, but from its lower side a sort of funnel, of the same size, descends perpendicularly about the length of its breadth, and then turns obliquely backwards and downwards, where it terminates in a vertical opening, that is closed by a stopper so as to be gas-tight, and is secured by a cross bar. Through a tube in the upper end of this piece, on a level with the centre of the body, another long bar, having a cross handle like the first, enters, and is made fast to a second moveable partition, similar to the upper part of the other, but as much less than it in depth as the thickness intended for the layer of coals at the bottom of the body of the retort. Two ribs, enlarged at their lower sides, project from the upper part of the inside of the body, which enter into corresponding notches in the moveable partition, to keep it from hanging down lower than it ought; and though the other moveable partition does not require support so much, yet for greater security it has similar notches, by which it glides along the same ribs.

When the retort is going to be charged with coal, the larger moveable partition is drawn by its handle close up to that end of the retort, and the smaller one is pushed in by its handle from the other extremity close up to it; the coals are then put into the hopper, and the door fastened close down over them; and as they fall between the smaller partition and the body, when this one is drawn back again, its lower edge will spread them evenly over the bottom of the retort. In this state of the apparatus the two handles project nearly their full length from the opposite ends of the retort; and as they would be in the way of the workmen, if left so, they are made to unscrew close to the retort, and are then taken out and hung up till the next charge is going to be put in, at which time the handle of the large partition is screwed on first, and by it this is pushed forward into the retort; which drives all the coke into the descending receptacle at the other end, and clears the body for the new charge. The stopper of this coke receptacle is then opened, and the coke is raked out; and when this is done, the stopper is fastened on again as at first, and the handle being screwed to the smaller raking partition, it is pushed forward, and the larger one drawn back as at first to the charging end of the retort; the coals are then put in through the hopper as before, the raking partition drawn back, and the handles again unscrewed.

The apparatus of the patentee for purifying the gas is of two sorts. An idea of the first may be conceived by supposing a cylindrical vessel, of great breadth, with a large tube rising up in its centre, and three concentric cylindrical partitions rising from the bottom around the tube, and of course between it and the external side, the junctions of which with the bottom are all impervious to water. This construction will divide the original broad cylinder into four annular vessels, for each of which a vessel of somewhat smaller diameter than it being prepared, the smallest is first to be whelmed down over the central tube with its bottom upwards; that of the next size in like manner is placed over the next partition to the tube, and of course includes the smallest vessel within it; the third in size is then put in the same way over the second vessel and the second partition; after which, lastly, the fourth or largest vessel is to be placed in a similar position over the third vessel and the third partition, but so as to be closer to it at one side than at the other, in order to leave room at the opposite side between it and the partition for a large tube to descend from the level of the top of the partition through the bottom, for conveying away the gas to the gas-holder or gasometer. Three or more knobs or bosses are fixed to the bottoms of each of the internal inverted vessels, at equal intervals asunder, in order to leave space for the passage of the gas; and for the same purpose feet or stops are to be placed at equal distances round their edges, to keep them from touching the bottom, and rings are to be placed at the centres of the bottoms of each of the inverted vessels, to raise them up by a crane when required to be separated for cleaning the whole, or for repairs. The cylindrical partitions are all of the same height, which is about double that of the external side of the enclosing vessel, and from the bottoms of the three enclosures formed by them, next the central tube, large short tubes descend, furnished with water-tight stoppers, by which the purifying mixture may be conveyed away when its power is exhausted. This purifying mixture is to be put in the lower part of these enclosures to such a depth as will make it rise above the edges of the inverted vessels sufficiently to cause that pressure on the gas in passing through it which shall be judged most expedient. The outer enclosure between the side of the enclosing vessel and the partition next to it, is supplied with water alone at its bottom, as the gas does not pass through it, and the use of the water is solely to make a tight joint, or liquid luting, to the external inverted vessel, for which reason it should be of a greater depth there than the purifying mixture in the other enclosures. This external inverted vessel must be fastened down to the sides of the broad enclosing vessel by rings and shackles, or other means, to prevent the gas from making it, and the other inverted vessels rise above their original positions in the purifying mixture.

The apparatus being thus prepared, the gas from the retort, then admitted into the central tube, will rise through it, fill the first inverted vessel, and when its pressure becomes sufficient, will pass under its edge, through the purifying mixture, to fill the second inverted vessel, which includes the first cylindrical partition; under the edges of which vessel it will in like manner pass to the third inverted vessel, and over the second partition, and under the edges of that vessel, into the fourth inverted vessel, from whence it will be conveyed into the gas-holder by the tube before-mentioned. A variation of this apparatus is mentioned in the specification, which consists in having one common bottom for all the inverted vessels, which combination of them will then be formed like the lower vessel with the cylindrical partitions, but with the bottom upwards; in which bottom, opposite each of the inclosures, wide short tubes are to be fixed, with air-tight covers, through which tubes the purifying mixture is to be conveyed to the lower parts of these enclosures.

The second apparatus of the patentee for purifying the gas consists of three or more large air-tight vessels, connected by and furnished with tubes, in the following manner:—Into the top of the first vessel a large tube enters from the gas retort, and a second large tube, whose lower extremity expands like the mouth of a trumpet, proceeds from near the bottom of this vessel, passes through its top, and then bends round and descends into the top of the second vessel; from which another similar tube, formed like it at the end, and equally close to the bottom of the vessel, passes round into the third vessel; and a tube of a like form proceeds from near the bottom of this third vessel, and rising through its top go off sideways into the gas-holder, if but three vessels are used; but if the number of them be greater, tubes of the form described pass from one to the other successively in the same manner on to the gas-holder. The purifying liquor is poured into each vessel, so as to rise a sufficient height above the edge of the trumpet-shaped termination of the tube of communication, to produce the pressure required for the gas; and each vessel is furnished with a large short tube at top, having an air-tight cover, for admitting the purifying liquor; and a similar tube descends from the bottom of each of the vessels, closed by a stopper impervious to water, by which the exhausted liquor may be drawn off to make room for a fresh charge.

The number of purifying vessels in the first-described apparatus may also be increased beyond that mentioned, as well as in the second, by multiplying the parts necessary for this increase on the same principle by which those described are constructed, the method of effecting which may be easily conceived from the foregoing explanation.

All parts of this apparatus, not otherwise directed, are to be made in the usual manner, and of the materials commonly applied to them.

The additions directed by the patentee to be put to the gas retorts, would most probably be attended with beneficial results, not only as respects economy, from the same end pieces serving for several bodies successively, but in facilitating the operations of charging and of removing the hot coke by the workmen.

The second apparatus for purifying the gas is formed so exactly according to the principles of the apparatus, used on a small scale by experimental chemists, commonly called Wolfe's apparatus, but which was in reality first invented by the celebrated Glauber, that we much doubt if the patentee could maintain any exclusive right to its monopoly.

The first purifying apparatus, however, appears to us to be an original invention, but one which would be somewhat expensive to execute on a large scale. As the patentee has borrowed from experimental chemists in the instance mentioned, we think they may also in turn apply this last-mentioned apparatus occasionally to their purposes, as it could be so very readily constructed on a small scale by a number of different sized pans or jars, placed one within another, with a second corresponding set, whelmed over them in a reversed position.

Patent granted to Junius Smith, *of Old Broad-street, London, Merchant, for certain improvements on a machine for washing, cleansing, and whitening cotton, linen, silk, and woollen garments, or piece goods.* Dated January 20, 1823.

The washing machine of the patentee consists of a cylindrical cage, suspended horizontally on an axle running through its central line, and placed within a steam-tight polygonic case, sufficiently large to allow of its being turned round in that situation without impediment. This cylindrical cage or vessel is composed of two disks, of the diameter required, set opposite and parallel to each other at the distance of its length, and united together by small round bars passing between them, and fastened at their ends to the circumferences of those disks, with narrow intervals between them to admit the free passage of liquor. The internal part of this cage is divided into four or more equal compartments, by partitions passing from its central line to its circumference; and one of its disks or ends has an aperture in it opening into each compartment, for the admission of the goods which are to be submitted to its action; and the end of the external case has an opening, conveniently situated for passing the goods through it into the compartments of the cage, as they are successively turned round opposite to it, which opening is furnished with a door, that is afterwards closed so as to be steam-tight.

The axle of the revolving cage passes through stuffing boxes in the ends of the external case, and is supported outside by a strong frame at each end, which likewise sustains the external case, and it is made to turn round either by winches at the ends, moved by hand, or by a pulley or other wheel, fastened on it in the same manner, and worked by mill-machinery, set in motion by any of the usual powers.

For the admission of the different liquors and of the steam, to whose action the goods in the cage are to be exposed, a tube runs horizontally over the top of the external case, which communicates by a vertical pipe in its centre with another horizontal tube, which runs along the top of the case withinside, directly over the revolving cage, and parallel to its axle. This latter tube is perforated at its lower side with numerous small holes, like those in the head of a watering pot, through which the liquor admitted runs down in fine showers on the goods in the cage, as they revolve beneath, so as to wet every part of them equally. The external horizontal tube has a cock at each side of the vertical pipe, and another pipe and cock are represented in the drawing of the apparatus, placed directly over the vertical pipe, and which must be for the admission of water, though not particularly mentioned, as the cock in the external tube, next the winch end of the machine, admits, when opened, the alkaline liquor for removing grease or dirt from the goods, and the cock at the other side of the vertical pipe admits steam. There are also three cocks in the end of the external case, shown in the drawing, placed at nearly equal distances asunder between its bottom and the axle of the revolving cylinder; which we suppose are for ascertaining the height of the liquor within the case, the lower one being by itself sufficient for discharging it.

When garments or other goods are to be washed in this machine, the hot alkaline liquor is, by turning the cock that admits it, to be let down on them through the perforated tube, in the manner mentioned, as they revolve beneath it in the cylindrical cage; and when a sufficient quantity of this liquor is let in, which may be ascertained by the cocks in the end of the case, the alkaline liquor cock is closed, and the steam cock is opened, and the cage is then made to revolve until the joint action of the liquor and the steam has discharged the dirt from the goods; then hot or cold water is to be let in on them by the third cock, after closing the steam cock and letting off the alkaline liquor; and the machine is to be worked as before, until the goods are thoroughly rinsed.

The patentee states that steam of any heat, and alkaline liquor of any strength, may be used in the process. He also mentions that acid liquors may be conveyed through the tubes to the goods in the same manner as those of an alkaline nature, but does not particularize the manner of applying them. And he states that the steam, after being used in the washing machine, may be passed off in pipes to heat a room for drying the goods, so as to serve a double purpose; and that the alkali may be extracted from the soiled alkaline liquor, so as to be used over again, by evaporation and other means, which he does not detail.

The cylindrical cage and the case, it is stated, may be made of wood or metal, and when of the latter, that copper should be used in preference.

We are given to understand in the specification that the process mentioned will thoroughly remove all dirt from the garments or piece goods submitted to it, without any subsequent manual operation; which is a matter that we cannot help considering as somewhat dubious, as in all soiled garments, especially in those which have numerous plaits, there must be parts which no revolving in liquor could, we imagine, thoroughly clean, and for which friction of some kind would be absolutely necessary. We, however, have no doubt that the action of steam upon goods previously soaped, or impregnated with alkali, will very much facilitate the operation of washing, as we were informed in the year 1814, by a gentleman residing in Bristol, on whom we could rely, that the Rev. Mr. Cochin, Master of an Academy in the neighbourhood of that city, had the washing of his family performed on that principle, by which at least half the labour was saved. In his method the clothes were first steeped in a hot ley of soda and soap, and then hung up in a steam-tight closet, the door of which was made to close so as to keep in the steam; the cock of a pipe which led from the closet to a steam boiler was then opened, and the steam let in to act on the garments for about an hour and a half, which produced the beneficial effect mentioned, in the diminution of the labour on the rest of the operation, which was performed by rinsing in cold water, &c. in the usual manner.

The apparatus of the patentee is reported to be that used by the Steam-washing Company, whose caravans are so conspicuous in the streets of London, and which was established about the time of the date of the patent, which circumstance is in favour of its good performance; but whether it is used by them as an auxiliary instrument, to diminish the labour in the common process, or as the sole means of performing it, we are as yet unable to learn with any certainty.

The application of the revolving cage to washing is not new, as admitted by the patentee; we have seen hollow wheels of this sort, on a large scale, at work in bleacheries in the North of Ireland many years ago, but in them the weight of the linen in the compartments of the wheel, each of which probably contained from 20 to 30 pieces, materially assisted the operation, by pressing the water out whenever they came to the bottom of the wheel, and a constant stream of water being discharged into the wheel from above, removed any foulness immediately after it was loosened from the linen.

The assertion of the patentee that alkaline liquor of any strength, and steam of any heat, may be used in the process, must not be understood literally; since, if a strong solution of *pure* potash or soda were used, in conjunction with steam even of the common temperature, all woollen and silk garments submitted to their action would be speedily dissolved; it is probable, therefore, that carbonated alkalies were alone intended in this instance, and even with them some discretion as to their strength must be used by the operators.

We believe that the steam may be employed usefully after leaving the washing machine, as stated in the specification; but that the other economical process mentioned in it, of recovering the alkaline salt from the foul alkaline liquor discharged from the goods, can be used to any beneficial purpose, we have the best reason to doubt, as we know that it was tried many years ago by the chemical professor attached to the Society for the Encouragement of Arts, &c. in Dublin; and the general opinion of good judges from the result of his experiments, was, that the alkali recovered would not pay the expences incurred in the processes necessary for that purpose. There may, however, be situations where coals are sufficiently cheap to lower these expences so as to produce a balance in favour of the operation; but we cannot expect that this should ever happen in London or its vicinity.

Patent granted to ISAIAH LUKENS, *late of Philadelphia, but now of Adam-street, Adelphi, Middlesex, Machinist, for a surgical instrument for destroying the stone in the bladder without cutting, which he denominates a Lithontriptor.* Dated September 15, 1825.

THE patentee states his instrument for the purpose mentioned to be that invented by M. Civiale, of Paris, (long since made public) improved by the following additions.

M. Civiale's instrument consisted of a catheter or tube, of proper size, in which another tube was made to slide up and down, from the lower end of which proceeded four fine springs, which opened outward from the centre when pushed down beyond the enclosing tube, and which were again retracted within that tube when the inner tube, with which they were connected, was drawn upwards. To the ends of these springs a sort of net work was attached, which lay in the outer tube beneath them, and which formed a small purse, that opened sufficiently by the expansion of the springs, when pressed downwards, to receive within it the calculus; which being then held tight by it against the end of the outer tube, by the retraction of the inner tube and springs, was operated on by small drills, rasps, and saws, passed down through the tube so as to be divided into parts sufficiently small for exclusion through the urethra.

The addition of the patentee to this instrument consists of two other long fine springs (like flattened wires), one end of each of which is fastened by a sort of hinge to one of the two adjoining expanding springs of M. Civiale's instrument; and the two being then made to cross each other, their other ends are made to pass through eyes, like that of a needle, in the ends of the other expanding springs, after which they are passed upwards through the inner tube, through a lateral aperture in the upper part of which they come out, and are there attached to a ring that slides up and down on the tube, and has a screw in it at one side, by which it may be made fast to this tube at any height required.

A variation of this addition is made by uniting the ends of four of the long fine springs of the patentee to a very small ring, capable of passing through the inner tube, and passing their other ends through eyes made in the four expanding springs of the original instrument, drawing them through the inner tube, and through a lateral aperture near its top, and connecting them with a sliding ring on it, similar to that above described.

These fine filiform springs will, when separated by the expanding springs, form a receptacle for the calculus, which the patentee thinks can be managed with more facility than that of M. Civiale's instrument.

Besides this principal instrument, the patentee uses three others of an auxiliary nature; the first of which is a drill, with a chisel point for operating on the calculus, the chief particularity of which is its having a thick sliding ring on its upper part, which is capable of being fixed to it where desired by a lateral screw; the end of the tube through which it is passed is surrounded by a conical knob, whose use is to prevent the passage of the urine during the operation, while the sliding ring serves as a stop, by which the degree of the penetration of the drill may be regulated. The second auxiliary instrument differs from the first only in its cutting end, which has a very small blade, capable of opening to a rectangular position from it by a joint, and which shuts down into a cavity in its side when retracted; and the third instrument is what the patentee calls a pair of duck-billed forceps, for removing the small fragments of the calculus made by the drills. This forceps has at its end two small spoon-like cavities, which open out from each other by spring stems, which latter are surrounded by a small tube that, when pressed down, closes the hollow ends together, so as to enable them to pass up through the external tube, through which they and their enclosing tube have been passed down; and when the enclosing tube is drawn back from the hollow ends, they are opened out by the action of their spring stems, to receive a fresh portion of the abraded calculus. The other end of this forceps is formed into a ring, by means of which it can be readily introduced and extracted; and there are also two rings projecting, for a similar purpose, from the opposite sides of the top of the external tube, through which all the foregoing instruments are passed in their turns.

Lastly, the patentee describes a head for the drills, by which they can be worked by a bow, which only differs from the drill heads used by artificers of metals in having the bobbin, round which the string of the bow passes, enclosed by an external case for about three-fourths of its circumference, which prevents the string from coming off from it while in operation.

The chief objection to the additions made by the patentee to the original instrument of M. Civiale will arise from the danger of the long fine springs breaking during the operation, to which they would be liable from the tension which they would then suffer, when any parts of them which might remain in the bladder, would subject the patient to the risk both of dangerous inflammation, and of the broken piece of the spring forming the nucleus of a fresh concretion.

The use of such instruments as these should never be entrusted but to careful and skilful operators; a caution which appears the more necessary from the patentee seeming to be insensible of the delicate nature of the operation which his instruments are contrived to assist, by his mentioning in the specification, the head of the drill as being *pressed against the body of the operator* at the time when it is employed; which implies the use of a degree of force that would most probably break the finer parts of the instrument which held the calculus, and painfully, and perhaps dangerously, wound the patient.

We believe the first idea of an operation of this nature for the complaint mentioned, may be traced to the eccentric General Claude Martin, who died in India in the year 1800, after having amassed a fortune of 330,000*l.*, and being originally a common soldier, the son of a silk manufacturer of Lyons, and who was well known for his skill in mechanics, and the pleasure he took in pursuits in which that skill was exerted. Being afflicted with the formation of a stone in his bladder, and unwilling to undergo extraction by the knife, he made a file for himself at the end of a piece of steel wire, about a foot long, and introducing it by a catheter through the urethra into contact with the calculus, abraded a portion of it by this simple instrument, and had patience and resolution to repeat the operation daily as long as he could bear it, which was only a few minutes at a time, till, at the expiration of a year, he completely freed himself from his painful and dangerous burden.

Patent granted to JOHN GOTTLIEB ULRICH, *formerly of Bucklersbury, Cheapside, but now of Rosamond-street, St. James's Parish, Clerkenwell, Chronometer-maker, for certain improvements in chronometers.* Dated March 26, 1825.

THE specification of this patent commences with recounting the various imperfections to which the *train* or wheel-work of chronometers is subject, from the inequality of the action of the main-spring, the imperfect formation of the teeth of the wheels, and from the rapid movement of its remote extremity next the balance.

To remedy which evils the patentee states that he has invented the detached escapement, which is the subject of his patent, by which the train has no direct communication with the balance, but acts by the intervention of a separate spring and lever; which, besides impelling the balance at once in each vibration, lifts up the detent from the escapement wheel, and frees the balance from all other action on the work, but that of pressing back a second detent, which confines the head of the lever of the intermediate impelling spring, until this operation of the balance permits it to re-act on a pallet attached to its arbor, and gives it the necessary impulse. The train, after putting back the impelling lever under its detent, bends its spring further in the contrary direction, so as to increase its power. There are also stops and guides provided, which prevent the spring detent of the impulse lever from vibrating so as to risk missing its hold, and to hinder the detent of the escapement from *tripping*, or passing more than one tooth at a time.

The escapement wheel used in this plan has flat teeth projecting from its face, passing from the circumference a little way towards the centre, in the direction of the radii. These teeth act alternately on two pallets of an escapement, somewhat similar to the anchor escapement, but having its body of a semicircular shape, of which these pallets form the two terminations. The arbor of this escapement is at the opposite side of the escape-wheel from that of the balance; and close to this arbor, and between it and that of the escape-wheel, is the cock or piece which holds the intermediate impelling spring. This spring is quite straight, and does not extend further than to the edge of the escape-wheel, where an arm or lever is attached to it, and is continued in the same direction across the escape-wheel, till it comes near the arbor of the balance, from which arbor a pallet projects, to which the lever gives impulse when freed from its detent; the head of which detent lies close to it, and whose tail or spring part runs off at right angles from it to a cock, to which it is fastened, at about the same distance from the centre of the balance as this is from that of the escape-wheel.

The head of this detent, besides the catch which retains the top of the impelling lever, has also a very fine and tender straight spring at its opposite side, passing along it towards the arbor of the balance, from which arbor a second pallet projects, that, when the balance turns from the impulse lever, lifts up this tender spring without moving the detent; but which, on the return of the balance in the opposite direction, presses this spring against the detent, causes the latter thereby to move towards the escape-wheel, and thus removes its catch from the face of the impulse lever, and permits it to act on the other pallet, and through it to renew and increase the motion of the balance. The detent of the escape-wheel passes across the impulse lever at right angles also, and from the side of the latter a pallet projects, that forms an inclined plane, by which the head of this detent is moved out from the tooth of the escape-wheel on which it locked, after the impulse lever has impelled the balance, the same action of its spring serving for both purposes.

As soon as the escape-wheel is thus freed from its detent, it directly acts on the pallet of the escapement at the side next the detents, presses it from its circumference, and thereby causes the opposite side of the escapement to move in the contrary direction, and along with it an arm or lever, which proceeds from it parallel to the impulse lever, almost as far as the opposite side of the escape-wheel. This arm of the escapement, by this motion, comes in contact at its further end with the impulse lever, forces it back again until its head is retained by its own detent, and by doing so also removes its inclined-plane pallet from the detent of the escape-wheel, whose spring causes this detent immediately to return to its first position, and lock the next tooth of the escape-wheel; but the same motion of this wheel which brings a second tooth under the detent, also brings a tooth at its other side to act on the opposite pallet of the escapement, and press it in its turn from its circumference, and thereby bring back the arm connected with it to its first position, while at the same time a pin, that projects from its face at right angles, at the side next the escape-wheel, comes in contact with the spring of the impelling lever, bends it forward in the same direction, and increases its power for the next impulse in a similar manner to that, by which a coiled spring acquires greater force by being wound up.

The spring of the detent of the impulse lever is prevented from vibrating and missing its hold by an arm, which is attached to a spring placed at the side of it, next the escape-wheel with which it comes in contact, when the action of the balance presses it from the head of the impelling lever. And the detent of the escape-wheel is prevented from recoiling so as to pass more than one tooth at once, by a pin called the *swelling pin*, which is so placed, in a notch at the point of contact between it and the impelling lever, as to confine its motions within the bounds required.

The pallets of the balance arbor, those of the escapement, the catches of the two detents, and the inclined plane, by which the impulse lever acts on the detent of the escape-wheel, are represented as being made of rubies, or of other equally hard jewels.

The points which the patentee particularly claims in this mode of performing the escapement are,—1st, the freeing the detent of the escape-wheel by a force independent of the balance; 2dly, having the spring of the impelling lever bent up by the action of the train; 3dly, the contrivance of the stop to prevent the detent of the impelling lever from missing its hold; and 4thly, the addition of the *swelling pin*, by which the detent of the escape-wheel is confined from tripping.

We can hardly suppose that the patentee could be ignorant that all those imperfections of the wheel-work, main-spring, &c. of watches, which he has detailed in the beginning of his specification, were known near a century ago, and that a very good remedy was discovered for them in the detached escapement contrived by Peter le Roi, in 1748, and nearly perfected seven years before by Thiout. He should, however, have taken some notice of this, and not have so worded his specification as if he were the first discoverer of these imperfections, and the first also to propose a remedy for them.

The detached escapement of Le Roi so completely over-came the defects of the train, along with his improved method of producing isochronism, in the vibrations of the balance spring, that in the chronometer for which he was rewarded in 1766 he laid aside the fusee and chain, and made the maintaining power act immediately on the train of wheels; and the same method was afterwards tried by Arnold, with very good effect.

The interposing a spring between the train and balance, which was to be bent back or wound up by the former, and to act by itself on the latter, and which is proposed by the patentee as a remedy for the defects of the train, as if it were a new discovery, is, in fact, a very old invention, even prior to that of the balance spring, being the ancient remontoir first explained by Huggens in his Horologium Oscillatorium in 1765; claimed by Hooke as having been known to him in 1660; and supposed by Berthoud, in his Histoire de la Mesure du Temps, to have been first executed about the year 1600. Mudge used no less than two of these remontoirs in his well-known chronometer, one for each direction of the revolution of the balance, of which an account is given in the Philosophical Transactions in 1794; but Berthoud, who may be supposed to be a good judge of chronometer movements, has declared, relative to this invention, that it being indispensably necessary in a portable machine that the oscillations of unequal extent of the balance should be isochronous, if they are so the mechanism of the *remontoir* is of no use; and if they are not so, the watch will vary, notwithstanding the remontoir.

The peculiar application of the remontoir, and the detached escapement of the patentee, appear to us very little calculated for a portable machine, subject to the various motions and change of position which a chronometer must encounter. The great length of the impelling lever would of itself make it necessary that the chronometer, in which it was used, should be always so placed that this lever should lie in a vertical position, with its head downwards;

for if it were placed horizontally, its weight would cause its own movements to be interrupted by its friction against the detents and other parts, whose motions would at the same time receive reciprocal injury from its pressure; and the length of the detents would also occasion their motions to be impeded by similar causes. The arm attached to the escapement for pushing back the impelling lever, seems also objectionable from its length, and the unequal pressure which it would cause on the pivots of the arbor of the escapement, both from this cause and from its not being balanced by any counterpoise. The whole contrivance seems, moreover, extremely and unusually complicated for the purpose intended, to which, however, we should not have objected, had this complication been accompanied by real advantage; but when, for the reasons stated, it appears to us that this primary object is far from being effected, we cannot but consider the uncommon number of detents, levers, locking parts, and escapements, as a serious addition to the other defects of Mr. Ulrich's plan for the improvement of chronometers.

Patent granted to CHARLES JACOMB, *Basinghall-street, London, Wool-broker, for improvements in the construction of furnaces, stoves, grates, and fire-places.* Dated September 15, 1825.

THE first kind of grate, or fire-place, described in the specification of this patent, consists of a cylindrical cage, placed horizontally, which revolves on a hollow cylindrical axis, about a sixth of its diameter in breadth; the part of which axis, that lies inside the cage, is likewise formed into a cage by longitudinal bars, while its external extremities have no lateral perforations, but rest on stands or supports, excavated at their upper parts for their reception.

The external cage is composed of bars, placed lengthways, at equal distances, between two rings, into which they are rivetted; and the space between it and the hollow axis is divided into several compartments (three of which are represented in the figure given in the specification) by grated partitions, extending in the direction of the radii from the axis to the external bars. One end of the cylindrical cage is formed of a solid disk, with a perforation in its centre for the hollow axis ; but its other end is composed of as many iron doors as there are compartments, each being attached by hinges to the end of one grated partition, and fastened by a latch at its opposite side, to the extremity of that next adjoining.

When this cylindrical grate is to be used, one of the compartments is to have coals put into it through the door at its end, and cinders are to be laid over them, among which latter the fire is to be kindled ; all the other compartments are to be filled with coals only. As the fire burns up among the cinders, the coals beneath will be heated, and the hot vapour from them will pass through the cinders, and be partly consumed ; and after some time the whole of the coals in that compartment will be converted into coke, and cease to give out smoke ; at which time the cylinder is to be turned so far round that the coals in the next compartment may come under the burning fuel in the first, be kindled by it, and transmit their inflammable vapour through the red hot coke ; and this process is to be continued through all the compartments in succession, taking care to recharge with fresh coals those which have been exhausted, when they are sufficiently remote from the fuel in combustion not to be kindled by it in an improper direction.

The hollow cage-like axis admits air to supply the fire, and its use in this respect is more apparent when the cylindrical grate is used as a fire-place for a steam-engine boiler ; in which case it is to be placed in a cylindrical cavity made for it within the boiler, when its end, in which the doors are fixed, will form part of the closure of that cavity, and the air be chiefly supplied through the hollow axis. The patentee does not fully describe all the arrangements necessary for this application of the cylindrical grate, but it is obvious that some space must be left beneath for an ash-pit in the enclosing cavity of the boiler, and that this ash-pit should have a door in front below the others. The chimney or flue is intended to be continued from the opposite side of the cavity through the boiler, though it might be also made to come out in front over the doors of the compartments.

A variation in the construction of the cylindrical grate is mentioned by the patentee, in which its external grating is to be divided into separate frames at each compartment; which, by being furnished with hinges and latches, or hooks and loops, may serve as doors for the admission of the fuel, instead of those at the end of the grate before-described.

The second and last sort of grate, of which a description is given by the patentee, is of a rectangular form, somewhat deeper than its breadth; both its front and back are composed of bars like a common chamber grate; its bottom, which is composed of bars, rivetted in a separate frame, is fastened to the front by hinges, and by a latch or hooks and loops to the back; it has a top also formed precisely like the bottom, but having its hinges attached to the back, and its catches or hooks to the front. The sides or ends of the grate, which are best made of single plates, though they may also be composed of bars, have each a strong pivot projecting from its centre, on which the whole is supported by stands or upright frames, placed for that purpose, in each of which is a horizontal groove, in which the pivots rest.

These square grates are principally designed for chambers, and, when a fire is wanted in one of them, it is to be nearly filled with coals, on the top of which a fire of cinders is to be kindled, the cover of the grate being of course previously raised up and turned back against the back of the chimney. The inflammable vapour from the heated coals will, from this arrangement, pass through the burning fuel above them, and when they are so far consumed as to cease to give out more vapour, as much fresh coals are to be put in over them as the grate can hold; the grated cover is then to be brought forward, and to be fastened

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